DOCUMENT RESUME

ED 055 366 24 EA 003 869

AUTHOR	Burr, Donald F.
TITLE	Simu-School: A Tool and Process for Educational Planning. Final Report.
INSTITUTION	American Inst. of Architects, Washington, D.C.; Technomics, Inc., Chicago, Ill.
SPONS AGENCY	National Center for Educational Research and Development (DHEW/CE), Washington, D.C.
BUREAU NO	BR-0-I-125(X)
PUB DATE	Sep 71
GRANT	OEG-X-71-0007(057)
NOTE	91p.
EDRS PRICE	MF-$0.65 HC-$3.29
DESCRIPTORS	*Architects; *Community Involvement; Computer Science; Data Bases; *Decision Making; Educational Environment; *Educational Planning; Educational Problems; Management Information Systems; Planning; *Simulation; Technological Advancement
IDENTIFIERS	Simu School

ABSTRACT

The greatest challenge facing education today is the need to plan adequately for the future. Effective educational planning can work only if all elements of the community are involved in the decisionmaking process, the relevant factors and variables in the educational environment are considered, and the nature of the learning/teaching process in education is understood. As proposed, SIMU-SCHOOL would use simulation techniques to recreate the educational planning process. By utilizing a management information system as an educational tool, SIMU-SCHOOL would create a time-compressed simulation of a series of planning problems. Using this simulation technique, educational and community planners could become involved and would experience the results of their decisions within a few days instead of several years. (Author/RA)

~~BR~~ 0-I-125X
PA 24
EA

ED055366

U.S. DEPARTMENT OF HEALTH,
EDUCATION & WELFARE
OFFICE OF EDUCATION
THIS DOCUMENT HAS BEEN REPRODUCED EXACTLY AS RECEIVED FROM THE PERSON OR ORGANIZATION ORIGINATING IT. POINTS OF VIEW OR OPINIONS STATED DO NOT NECESSARILY REPRESENT OFFICIAL OFFICE OF EDUCATION POSITION OR POLICY.

Final Report

Project No. 0-I-125(X)
Grant No. OEG-X-71-0007(057)

Donald F. Burr, A.I.A.
American Institute of Architects
Northwest Region A.I.A.
6103 Mt. Tacoma Drive S.W.
Tacoma, Washington 98499

SIMU-SCHOOL

September 1971

U.S. DEPARTMENT OF HEALTH, EDUCATION, AND WELFARE

Office of Education

National Center for Educational Research and Development
(Regional Research Program)
Region 10

EA 003 869

Final Report

Project No. 0-I-125(X)

Grant No. OEG-X-71-0007(057)

SIMU-SCHOOL
A Tool and Process for Educational Planning

Donald F. Burr, A.I.A.
American Institute of Architects
Northwest Region A.I.A.
6103 Mt. Tacoma Drive S.W.
Tacoma, Washington 98499

September 10, 1971

The research reported herein was performed pursuant to a grant with the Office of Education, U.S. Department of Health, Education, and Welfare. Contractors undertaking such projects under Government sponsorship are encouraged to express freely their professional judgment in the conduct of the project. Points of view or opinions stated do not, therefore, necessarily represent official Office of Education position or policy.

U.S. DEPARTMENT OF
HEALTH, EDUCATION, AND WELFARE

Office of Education
National Center for Educational Research and Development
Regional Research Program
Region 10

PREFACE

The basic idea for SIMU-SCHOOL was conceived by members of the National Committee on Architecture for Education of the American Institute of Architects. This project is one in a series of public interest activities of this committee and the American Institute of Architects. A task force of the committee was formed to provide leadership in development of SIMU-SCHOOL and raise funds for preliminary design.

The American Institute of Architect's task force, consisting of three architects, later expanded to include three outstanding educators. Realizing the project was mostly educational, the task force also formed a consulting panel of ten persons prominent in education and architecture to seek their advice and counsel in the further development of SIMU-SCHOOL. These consultants and members of the task force are some of the most capable educational planners in America. All of those involved have given time, effort, and money far beyond the value of the formal grants that were given for initial research.

The task force next engaged the services of Technomics Inc. to develop the technical methods to make the construction of SIMU-SCHOOL possible.

Without the great help of all these people and their commitment to assisting education in America, the idea of SIMU-SCHOOL probably could not have been brought into reality. In behalf of education in America, sincere thanks is expressed to the following persons, who have brought SIMU-SCHOOL nearly to the point of reality.

SIMU-SCHOOL Task Force of the Committee on Architecture for Education, American Institute of Architects:

Donald F. Burr, A.I.A., Chairman
Tacoma, Washington
James A. Clutts, A.I.A.
Dallas, Texas
John B. Rogers, A.I.A.
Denver, Colorado
Dr. John L. Cameron, Honorary A.I.A.
U.S. Office of Education
Dr. Donald J. Leu, Dean, School of Education
San Jose State College
Alan C. Green, Educational Facilities Laboratory
New York City

SIMU-SCHOOL Consulting Panel:

Dr. Robert W. Blanchard, Superintendent of Schools
District No. 1, Portland, Oregon
Dr. Frank A. Brunetti, School Planning Laboratory
Stanford University

Charles Cassell, A.I.A.
Washington, D.C.
Dr. Donald M. Christensen, Superintendent of Schools
Castle Rock, Washington
Dr. August Gold, Consultant
Educational Facilities Laboratory, N.Y.C.
Dr. Joseph Hannon, Assistant Superintendent,
Facilities Planning, Chicago Public Schools
Dr. Hugh Holloway, Superintendent of Schools
Burnsville, Minnesota
Sterling Keyes, Associate Superintendent for Admin.,
Finance and Planning, Baltimore City Schools
Milton Miller, Director of Educational Facilities Planning
Grand Rapids, Michigan
Harry Saunders, Director of School Building Planning
Los Angeles Board of Education

Technomics, Inc.:
Roy Davison, Senior Systems Analyst
Byron B. Morre, Director, Computer Systems
Dr. Burton R. Wolin, Vice President
Dr. Beatrice K. Rome, Consultant
Dr. Sidney C. Rome, Consultant

END, PREFACE

TABLE OF CONTENTS

INTRODUCTION.....Page 1

METHODS.....Page 3

RESULTS.....Page 6

CONCLUSIONS.....Page 7

RECOMMENDATIONS.....Page 8

APPENDIX MATERIALS.....Page 9

END, TABLE OF CONTENTS

INTRODUCTION

To grasp the concept of SIMU-SCHOOL you need an awareness or understanding of three things. These are:

- °What is meant by a large, computer based, simulation.
- °What are the basic principles and parts of the educational planning process.
- °An awareness of the problems now faced by American education.

Simulation has been used extensively by private industry, the military, economists, and other social scientists. Simulation has been defined by various writers in various ways. In most of the definitions, reference is made to models and computers. Essentially, the idea is that although a complex reality cannot be brought into a laboratory and studied, a representation of reality can be processed by computers and experiments can be conducted on such representations or models. Simulation for the analysis of complex systems and the planning for future events or programs has come into wide spread use by many elements of the government, military, and private enterprise. It has also been used in small segments concerning some of the problems facing education. The simulation for SIMU-SCHOOL addresses itself to the total planning process, which is clearly a new endeavor for education. It is important and necessary that you have at least a general understanding of simulations, particularly those large in scale.

In technical terms, SIMU-SCHOOL is a simulation of the total educational planning process. It is, therefore, important that you understand the basic elements of this planning process. Many variables exist in planning for education, as they do in any planning endeavor. There is, however, a process that can be defined, and, once understood and used, it becomes the "path for planning". In the earlier phases of development of SIMU-SCHOOL, much time was spent in simply defining the process of educational planning. Perhaps, if this project does nothing else it will have assisted significantly in pulling together the many scattered pieces of knowledge concerning planning and putting them into a logical series of steps. This in itself will be of major assistance to all those involved in planning for the future of education.

We are confronted with many problems as we look at and work with education today. The awareness of these problems varies greatly, but most realize that we are in a time of crisis and must find new methods to determine solutions. In many cases, the educational machinery is bogged down in a hopeless maze. Pressure groups force ideas to be adopted, and even though the idea itself may have merit, if it is not considered in relation to other ideas it perhaps could destroy an educational system in four or five years. We have the problems of segregation, urban decay, the vast array of new knowledge, and many others. We are clearly in an era of shared decision making. We must have methods to utilize the output from the community so that all ideas are put into proper perspective in formulating plans for the future of education.

SIMU-SCHOOL creates, through simulation, the "path for planning". Once on this path, the planner has a way to move through the maze of detail that must be considered. This path for planning is the heart of the SIMU-SCHOOL concept.

END, INTRODUCTION

METHODS

The initial idea for SIMU-SCHOOL was conceived in February of 1970. During the past eighteen months, the A.I.A. task force, in close co-ordination with its group of ten consultants, met, studied, and discussed the feasibility and the practicality of the SIMU-SCHOOL concept. Untold hours have been spent by these experienced educational planners in defining the educational planning process, discussing how to adapt it to a simulation mode, and, lastly, discovering and establishing the form of SIMU-SCHOOL so that it would become a useable tool in the educational planning process.

Extensive surveys were made to determine whether or not this type of a simulation had been done. Although many small pieces were found, which in themselves could become part of SIMU-SCHOOL, nothing could be found that approached the total application of simulation to the educational planning process as envisioned in SIMU-SCHOOL.

Much had to be learned concerning the technology of simulation and the feasibility of the project. The firm of Technomics Inc. (7405 Colshire Drive, McLean, Virginia 22101) was engaged to not only receive the information developed by the task force and the board of consultants, but also to bring to this project the necessary technical information to assure its practicality and its feasibility for construction. The firm of Technomics also went beyond its own staff and engaged consultants renowned in the process of simulation.

Thus the process of development of this project not only brought together some of the finest educational minds in America and some of the finest educational planners, but it also attempted to bring the greatest possible amount of information concerning all the technical aspects of simulation so this could be applied to the development of SIMU-SCHOOL. There is no question that SIMU-SCHOOL can be achieved from a technical standpoint. Whether or not this happens depends largely on the commitment of education to find a way out of the jungle it is now in.

The documents included in the appendices of this report present detail concerning what SIMU-SCHOOL is and how it is used. To avoid redundency this information will not be repeated here. These documents are in two volumes. The details of the SIMU-SCHOOL concept are given in them. Like most creative projects time moves quickly and, thus, already SIMU-SCHOOL has advanced beyond that discussed in these reports. The appendices are further divided into three broad sections giving a quick overview for casual reading and are then followed by greater detail giving technical aspects and projected work plans for the development of this project.

It is important to realize that the basis of SIMU-SCHOOL is the simulation of the educational planning process, but in addition to this it con-

tains other valuable data. In the data bank for SIMU-SCHOOL can be stored the vast knowledge that we have concerning education. New information can be placed into this data bank, and all of it can be made quickly available to those involved in educational planning. Another way of stating this would be to make available to those charged with the responsibility of educational planning, information concerning all of the "options" that are available to them.

Another valuable bank of data that will be built into this planning tool will be the demographic data of the actual community where the planning is taking place. Thus, with a process or path for planning, knowledge of the real world that makes up the educational community, and knowledge of the options available, those responsible for planning have at their fingertips a variety of tools that immensely increases their ability to plan for the future of education.

Shared decision making is clearly a condition of our time. Total community involvement is extremely difficult, but perhaps the most difficult task of all is to be able to take the input from a wide variety of people and put it together in some meaningful plan that will advance and improve education, and, most of all, prepare it for the future.

Through the process of educational planning embodied in the basic simulation of SIMU-SCHOOL and the other information that is contained, decisions can be put together and the ultimate ramification of these combined decisions can be seen or understood in an extremely compressed period of time. This enables not only the proper combination of decisions, but also enables the planners to branch out far more into the maze of detail and test the new methods, new ideas, and new ways to achieve their goals.

One of the basics of SIMU-SCHOOL is an improved method for community involvement. Initially, it can serve as a means for people to learn the rudiments of the process of educational planning. They can learn the significance of the careful putting together of these decisions so as to achieve goals and not to destroy the very thing they set out to improve. Thus, lay people become meaningful contributors to the process of planning for education. SIMU-SCHOOL, as you will learn, is not something that you look at or listen to. It is something you become involved with. It is a large simulation suitable for involving thirty to forty people at a time. It will be both in a permanent form, that is permanently based, and also in a form that is transportable. This is necessary so that it can be brought to any educational setting in America.

Once the basic elements of planning are understood through involvement with SIMU-SCHOOL, then the tool and process can move ahead into the next phase. This will include building into the simulation real data from the actual community where the planning is taking place. Also, it

should be remembered that at the central home of SIMU-SCHOOL there will be a vast data bank of information concerning education that is available to the group that is doing the planning. Thus, the planning process, the actual data of the community, and the knowledge concerning education can be brought together in a meaningful way to plan education for a community.

In some cases the centers for SIMU-SCHOOL will be permanent, such as the urban center for planning now under way in Chicago. This is the first real segment of SIMU-SCHOOL under development. Perhaps most major cities will have such permanent centers within the next four or five years. The other educational settings in America, such as suburban and rural, can receive the benefits of this planning tool because of its mobile nature. During development, methods will be made to create forms of SIMU-SCHOOL that are transportable to any place in America.

Another valuable use for SIMU-SCHOOL is the training of future educational planners. This will probably take place at a national center for planning; but again, elements could be brought to the institutions of higher learning for use by these men and women who will become our planners of tomorrow.

END, METHODS

RESULTS

SIMU-SCHOOL is clearly possible to construct. Already the significance of this project has been realized and funding in the amount of Five Hundred Thousand Dollars has been provided by the U.S. Office of Education for further development. In the city of Chicago the project of SIMU-SCHOOL is under way. It is titled The Urban Center for Planning. Chicago is developing a management information system. A characteristic of the project in Chicago is that actual data concerning the Chicago school system and its entire community will be built into the data bank. Dr. Joseph P. Hannon, assistant superintendent of schools, is the project director for the SIMU-SCHOOL Chicago project. The decision to have a project in Chicago stemmed largely from the need to be certain that SIMU-SCHOOL in its final form is acceptable and useable by the educational planners. All during the process of discussions and development for this project, the idea was constantly put before actual users to see whether or not this would be something they felt was in a form that would improve the planning process. Thus, Chicago, with its real data, initially confronts SIMU-SCHOOL with producing a "users' model".

A second project will soon be started in Santa Clara County, California. It will be under the overall guidance of Dr. Donald J. Leu, Dean, College of Education, San Jose State College. The primary purpose of the California project is to develop the simulation model of the educational planning process. The work tasks of the Chicago project and the Santa Clara project will be carefully coordinated so there is not an overlapping of effort in their work. The actual SIMU-SCHOOL will emerge as a result of combining the results of these two projects.

It is further envisioned that SIMU-SCHOOL will have a home base and will become a national center for planning. Here at this center will be the basic computers and the bank of knowledge that SIMU-SCHOOL will contain. The receiving of information, the management of the information in the system, and the distribution of this to all segments of the educational community will be the responsibility of this national center. SIMU-SCHOOL will be an on-going planning tool. Once created, it will provide a communicating means to receive new information and to distribute it to the educational community. There will be some permanently anchored units of SIMU-SCHOOL. These will probably be in our major cities or in our major educational institutions. There will also be mobile versions of SIMU-SCHOOL which can be sent from the national center to any educational community in our country.

The overall management of SIMU-SCHOOL will be provided by the Council of Educational Facilities Planners. They will have the responsibility for guiding the Chicago and California developments, and also for the establishment and operation of the national center for planning.

END, RESULTS

CONCLUSIONS

The conclusions of the task force and consultant panel are that a planning tool such as SIMU-SCHOOL is urgently needed. The importance and the significance of creating these methods to improve our planning processes for education cannot be over-emphasized. There is need for all possible speed, as even following the most rapid time table possible, it will still take upwards to two years to bring SIMU-SCHOOL into a reasonable operating form.

A danger that exists is that people will want to look at SIMU-SCHOOL as a panacea. It is not. It is simply another series of tools that, when built, will improve the process of educational planning. It is a series of tools that are designed to meet the needs of today as we plan for the needs of the future.

All those involved in the planning of SIMU-SCHOOL also stress the importance of remembering the basic goals of this project. SIMU-SCHOOL cannot solve all problems, but it can most significantly improve our educational planning processes. It should be developed in small workable pieces at first, and then gradually built in a logical sequence into a larger form. If, for any reason, it attempts to initially move too rapidly, or to include too many things, it could endanger its ultimate successful completion.

END, CONCLUSIONS

RECOMMENDATIONS

Steps should be taken to provide full assurances that SIMU-SCHOOL is preserved for all of education. It should be copyrighted or patented so that it belongs to the public sector and does not fall into the realm of a private, profit-making, enterprise.

Lastly, SIMU-SCHOOL must, as far as opinions on education are concerned, remain neutral. It must be a freeing device, not a restricting one. Its purpose is to improve the process of educational planning, and create the framework so that this process follows the best methods and utilizes all our knowledge. SIMU-SCHOOL must not, however, in any way project or suggest how to run an educational system. The How or the Way is to be the result of the planning process. If there is one danger in SIMU-SCHOOL it will be the great accumulation of knowledge and information stored in computers could be manipulated to, in itself, say how education should operate. This must not happen and all steps must be taken along the way to assure that SIMU-SCHOOL remains neutral and that it is so managed to serve all of education.

END, RECOMMENDATIONS

APPENDIX MATERIALS

Included in the Appendix are the following documents:

Document A. This document, with the blue cover, explains SIMU-SCHOOL in greater detail. It is deliberately written in two sections; the first providing a quick over-view; the second providing a more detailed discussion of SIMU-SCHOOL. This document was prepared by the firm of Technomics, Inc. as a result of the information developed during the conferencing with the task and consultant panel concerning SIMU-SCHOOL.

Document B. This is the document with the orange cover, and it presents an analysis of work tasks for the development of SIMU-SCHOOL. This analysis of the work to be done was completed last May, and by necessity has undergone changes as funding has been received and assignments made. It will undoubtedly undergo further changes. It will, however, provide for you some understanding of the things to be done in the development of SIMU-SCHOOL.

Document C. This is the document in the white cover, and it presents the framework for the Central Management of this project. Once the National Advisory-Planning Board has been appointed they, of course, will have as their initial responsibility the establishment of policy and take the necessary steps to firm all of the proceedures for the central management operation.

END, APPENDIX MATERIALS

Working Paper

SIMU-SCHOOL

CENTRAL MANAGEMENT

"A Definition -- Tasks -- Responsibilities"

Reference Paper

Simu-School Task Force
August 1971

CENTRAL MANAGEMENT FOR SIMU-SCHOOL

A. RATIONALE

The need for a strong, coordinating, central planning, development, and management for Simu-School is mandatory. The current division of the project into two parts (Chicago and Santa Clara) has created the urgent need for a strong central coordinating component. The work tasks done by these two developmental projects are different and require careful coordination so that the results of these and other future projects blend together in the creation of the educational planning tool and process called Simu-School.

When Simu-School is operational it will be the primary component of a national (or inter-national) center for educational planning. The preservation of Simu-School for all of education everywhere is essential, and this can only be achieved through a strong central management center.

There is the possibility that another concurrent development may take place. The Province of Alberta in Canada may wish to start another developmental project at the University of Alberta in Edmonton. The broad function of this project would be development of the components of Simu-School particularly adapted for training future educational planners. If this materializes it would further increase the need for strong management to supply the overall guidance and coordination necessary to properly examine work tasks and to bring them all together at the proper time into the formation of the educational planning process and tool -- Simu-School.

Another urgent need is for the writing and publication of materials describing Simu-School and recording its progress to a vast number of potential users. Much has to be done in this regard to familiarize people with this tool and to set the stage for its ultimate massive use.

Lastly, it is of the utmost importance that the basic neutrality of Simu-School be guarded and preserved. Its purpose is for planning, and not to project a specific way to run a school system. The central management of Simu-School must be structured to make certain no person, group, or agency violates this concept of neutrality.

B. BASIC PARTS OF CENTRAL MANAGEMENT

1. NATIONAL ADVISORY-PLANNING BOARD

°Responsible to provide not only the needed expertise, but also the inspiration to lead Simu-School in achievement of its goals.

°Preserve Simu-School for all of education.

°Keep Simu-School neutral in relation to proposing ways to run schools.

°Make certain that all proposed users are provided for -- that is, the inexperienced user, users of intermediate experience, and the professional planner.

°Make certain ultimate design and form of Simu-School provide for easy and practical use by all parts of the educational system -- that is; urban, suburban, and rural; private and public; all levels from pre-school to senior citizens.

°To search the future for new options for education.

°Seek ways to refine and improve the educational planning process.

°To become the policy making body for Simu-School.

°Establish operating procedures and policies as a guide to central management.

2. THE COUNCIL OF EDUCATIONAL FACILITY PLANNERS

°This organization will have the responsibility for overall management of Simu-School.

°To provide the leadership during development to assure creation of the real Simu-School.

°To focus events necessary to bring about a national (or international) center as the home base for Simu-School and educational planning.

°To guide and manage public relations for Simu-School.

°To set steps in motion to make Simu-School ultimately self-supporting.

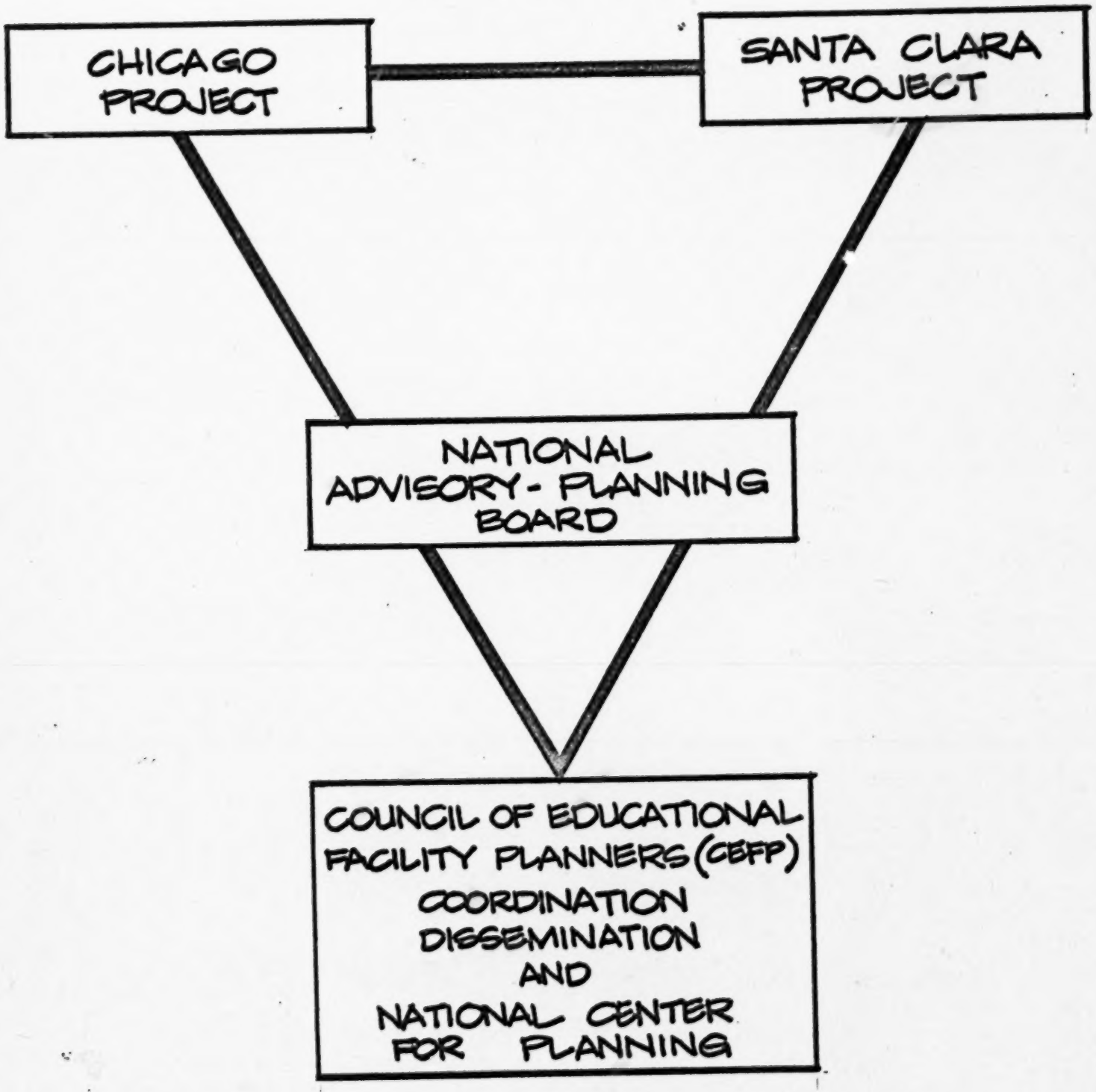
°To seek funding until the development of Simu-School is complete and it is a self-supporting operation.

3. THE CENTRAL MANAGEMENT STAFF

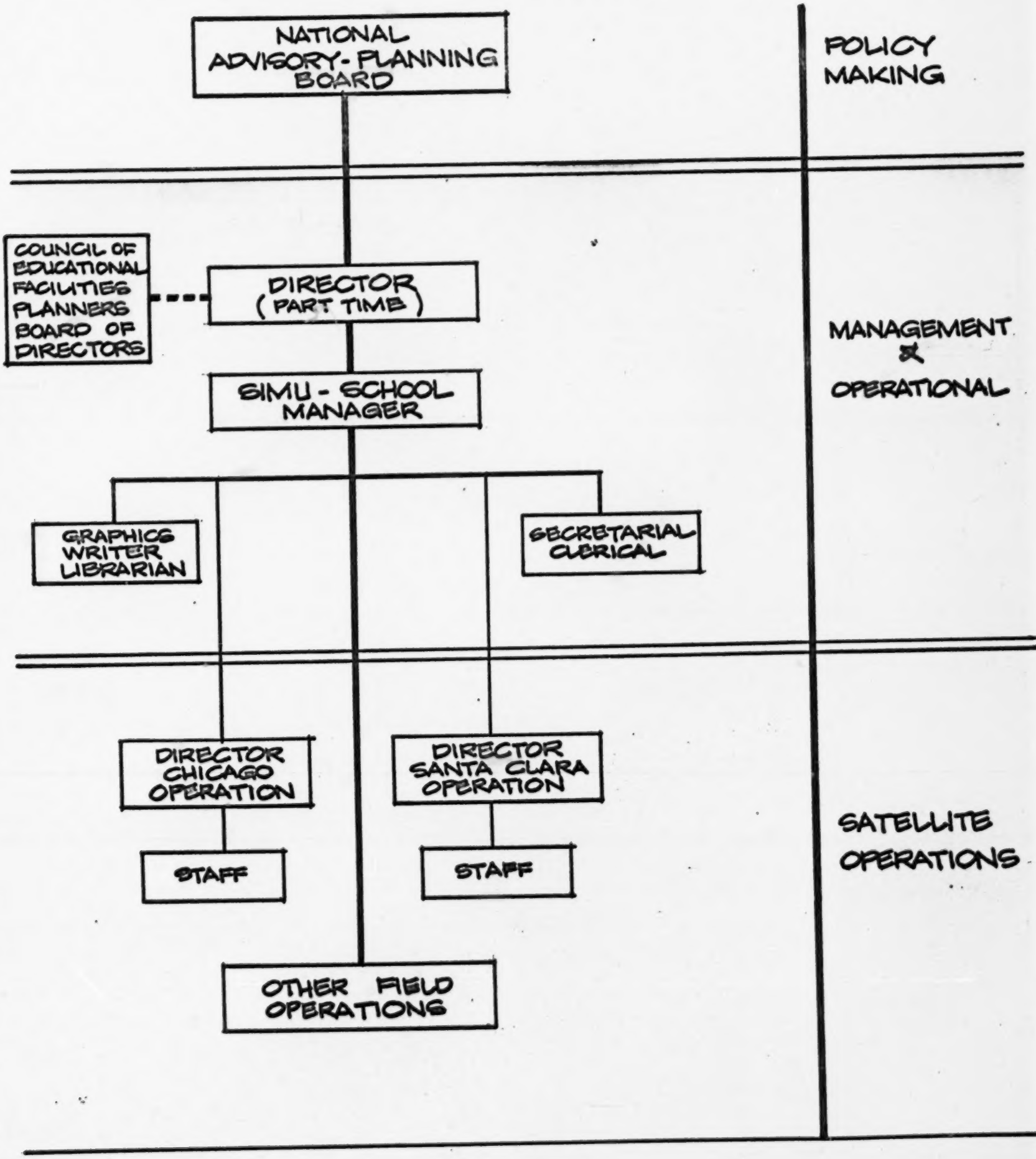
°This staff will have the responsibility of developing and operating Simu-School under the policies and procedures established by the advisory board.

C. GRAPHIC DESCRIPTION OF CENTRAL MANAGEMENT

RELATIONSHIPS
SIMU - SCHOOL CENTRAL MANAGEMENT



ORGANIZATIONAL CHART
SIMU-SCHOOL CENTRAL MANAGEMENT



D. CENTRAL MANAGEMENT ORGANIZATIONAL DETAILS

The following is a beginning in the establishment of operating procedures for central management. It is realized by the Simu-School Task Force that ultimately the advisory-planning board that is to be created will have the responsibility for creating these details. What is necessary now is to provide a starting point, and that is the purpose of this paper. Ultimately, the advisory-planning board must adopt and authenticate its own policies and procedures. We are attempting in this paper to identify those elements involved in establishing a strong central management unit and to suggest a management and operating structure with financial resources to support this needed activity.

1. NATIONAL ADVISORY-PLANNING BOARD

°This advisory-planning board will be the policy making body concerned with the establishment of operating procedures and guidance of the central management staff. It is hoped they will adopt those commitments previously established in this paper. This group of People will be appointed by the current Simu-School Task Force. Appointments will be based upon certain criteria, generally as follows:

- Persons who have proven expertise in education or the educational planning process.
- Persons representing diversity of background, geographical areas, and interests. It is essential that the three broad educational settings be represented. That is, the urban, suburban, and rural.
- The advisory-planning board must also have representation from government and funding agencies.

°Once created, replacements on the advisory-planning board could be made by a majority vote of the advisory-planning board with due regard to the background and interests of the person to be replaced.

°It is anticipated that the advisory-planning board will convene approximately four times annually to review the work of the project staff, to provide guidance, to set goals and priorities and to establish policy.

2. CENTRAL MANAGEMENT

°As previously presented in this paper, the Council of Educational Facility Planners will be the central management organization for Simu-School. This organization, relating to the national advisory-planning board of Simu-School and to its own board of directors, will asuume this responsibility.

°Funding for central management will go directly to the Council of Educational Facility Planners for their use in exercising this management role of Simu-School.

3. CENTRAL MANAGEMENT STAFF

°The central management staff will have complete responsibility for developing and operating Simu-School under the policies and procedures established by the advisory-planning board. Initially, five persons (see organizational chart) will have the responsibility for operating and managing Simu-School. The Director, who will serve about one-fourth of his time, will have overall responsibility for implementing and coordinating the policies and procedures which have been set. The Simu-School Manager will serve full-time, coordinating the activities of the writer-librarian and the secretary, as well as the major thrusts by the field operation.

°It is essential that the Simu-School Manager have a working knowledge of the educational planning process, simulation techniques, and the operational aspects of the computer. He must have the ability to work with many diverse groups of people. This person must be a top professional.

°Due to the need for a continuous information search, a full-time writer-librarian will be needed to gather materials on simulation technology, innovative instructional programs, major social problems, and issues which will be useful in operating Simu-School. It will be necessary to maintain an index or catalogue of these materials, as well as provide a means for dissemination of new materials. Since it is important to prepare a scenario, role materials, and information materials, this person working with the Director and Simu-School Manager will need sufficient time to accomplish these tasks.

°The need for first class graphic materials to tell the Simu-School story will necessitate the need for a part-time person with graphics capability. It is anticipated that about one-eighth time of a graphics person will be needed during the first year.

°One full-time secretary to serve the correspondence needs of the staff is needed. Schedules need to be arranged for the staff to meet with the field operations and the advisory-planning board. Arrangements and correspondence with interested persons or groups to describe Simu-School will be necessary, as well as the scheduling of Simu-School for participating groups.

°Simu-School coordination is the greatest need at this time. The division of the project into parts that are geographically separated has created a need for a strong coordinating component. There appears to be a need for two main instruments of coordination. One is a set of documented system specifications, the other a series of system tests to evaluate the work that has been done and indicate changes that must be made.

°The formulation of system specifications and test plans must be a joint undertaking of all participants under the coordination of the central management and subject to periodic review by the advisory-planning board. The coordinating function will include responsibility for evaluating and reporting the results of system tests and for maintaining the extensive documentation needed to keep the system specifications up to date. Another responsibility will be that of planning such other procedures as are necessary to insure that the separate arms of the project move toward common goals.

°In addition to the coordination function, there are several other tasks to be performed by central management of Simu-School. They are:

- Arrangements for computer support.
- Production of materials for Simu-School.
- Continuous search for information related to simulation technology, innovative instruction programs, major social problems, and issues and graphic materials.
- Development of a library of materials and information.
- Make arrangements for computer access to support the work of developing Simu-School.
- Prepare a scenario to define and coordinate the instructional aspects of Simu-School.
- Develop materials for each different role to be played by the participants of Simu-School.
- Prepare information materials and instructions to assist each participant in Simu-School.
- Design and build the visual setting using various instructional aids and visual displays.
- Arrange for packaging and transporting the stage setting.

- Plan field operations to the extent that problems are identified and resolved ahead of occurrance.
- Train field-unit directors in group processes, in instructional technologies, particularly simulation technologies.
- Write a directors' manual on Simu-School's operating procedures.
- Edit and produce documents used in Simu-School exercises and in other public releases.

4. PROPOSED BUDGET

°It is estimated that the budget for the central management during the first year of operation will be as follows:

Salaries and Benefits		$59,360
Director (1/4 time)	$ 7,000	
Manager	24,000	
Editor-Librarian	13,000	
Graphics	3,000	
Secretarial	6,000	
Benefits @ 12%	6,360	
Travel		16,250
Staff	4,250	
Advisory-Planning Board	10,000	
Consultants	2,000	
Space and Equipment		2,350
Rentals (Central Management)	2,350	
Operations Costs		9,800
Postage, supplies, telephone	2,400	
Printing and reproduction	5,500	
Bookkeeping and Audits	1,900	
Overhead		8,776
TOTAL		$96,536

It is felt that a sum of $100,000 is approximately correct as the monies needed for the first year of central management of Simu-School. It is probable that the second and third years will have some increases, but they will be slight. To provide the necessary continuity, it is felt by the Simu-School Task Force that if at all possible funding should be obtained in the amount of $300,000 to assure three years of operation of the central management of Simu-School. A shorter time of funding could place the project in jeopardy.

END, WORKING PAPERS, CENTRAL MANAGEMENT, SIMU-SCHOOL

SIMS-SCHOOL Task Force of the Committee on Architecture
for Education, American Institute of Architects

Donald T. Rowe, A.I.A., Chairman
Tucson, Arizona

Ben A. [illegible]
Dallas, Texas

John R. Rogers, A.I.A.
[illegible]

[illegible], A.I.A.
[illegible]

Dr. Harold D. Long, Dean, School of Education
[illegible]

Robert E. [illegible], Director, Educational Facilities Laboratories
New York, N.Y.

[illegible]
Washington, D.C.

Dr. [illegible], Planning Director
[illegible]

Dr. [illegible], Director, Systems Analysis
Bureau of Research, Division of Elementary-Secondary Education
U.S. Office of Education

Dr. Norman D. [illegible]
[illegible]

Dr. Beatrice [illegible], Consultant

Dr. Sidney G. Rowe, Consultant

SIMU-SCHOOL

. . . Work Plan and Costs

May, 1971

CONTENTS

INTRODUCTION	1
STATEMENT OF WORK	2
WORK PLAN	3
COSTS	16

INTRODUCTION

The contract under which these materials were prepared instructed the authors to provide a document describing SIMU-SCHOOL (the prospectus that accompanies this work plan) and to submit an "estimate for the production cost of SIMU-SCHOOL," an "estimated timetable for the production," and "such information as possible concerning the cost of ownership and the cost of operation of SIMU-SCHOOL." The compiling of these estimates required that the production work be planned in some detail. The plan is outlined here.

It was further necessary, in writing the work plan, to discuss certain aspects of the design of SIMU-SCHOOL at greater length than was suitable in the prospectus. Thus, the work plan and the prospectus together constitute "outline specifications" of SIMU-SCHOOL, as called for by the contract. Every effort has been made to bring this initial, tentative design of SIMU-SCHOOL abreast of tested states-of-art in instructional method, simulation technology, and planning technology.

AN EVOLVING DESIGN

The initial design also contains elements that will foster change in the design itself. It should be emphasized that SIMU-SCHOOL is meant to evolve continuously. The work plan that follows reflects this important attribute of SIMU-SCHOOL and establishes a process that permits -- requires -- design work to proceed concurrently with the development effort. The initial descriptions of SIMU-SCHOOL cannot be taken as final or definitive. Th
different direction by r
new concepts. Funding a
on the project and may r
recast or the work exter

PROJECT RESPONSIBILITIES

Initial financial arran
SCHOOL emerged even as
The arrangements call f
part will be carried on
cago Public Schools; th
County (California) Sch
sponsibilities creates
agency in the form of a
The location and exact
not yet been determined

Separate proposals of w
these three sources. T
ity for the three have
tus. However, no effor
ing pages to anticipate
tasks among the partici
to outlining the entire
formed, whether by one
SIMU-SCHOOL in accord w
in the prospectus.

final or definitive. The work may be pushed in a different direction by new technologies, new needs, new concepts. Funding arrangements, too, will bear on the project and may require that the design be recast or the work extended in time.

PROJECT RESPONSIBILITIES

Initial financial arrangements for producing SIMU-SCHOOL emerged even as these pages were being written. The arrangements call for the work to be split. One part will be carried on under the purview of the Chicago Public Schools; the other, of the Santa Clara County (California) Schools. This division of responsibilities creates the need for a co-ordinating agency in the form of a National SIMU-SCHOOL Center. The location and exact nature of such an agency have not yet been determined.

Separate proposals of work will be forthcoming from these three sources. Tentative areas of responsibility for the three have been suggested in the prospectus. However, no effort has been made in the following pages to anticipate the allocation of specific tasks among the participants. This text is confined to outlining the entire set of tasks that must be performed, whether by one agency or another, to develop SIMU-SCHOOL in accord with the description contained in the prospectus.

STATEMENT OF WORK

The work plan to be described here will yield these products at the end of the 12th month of work:

- A fixed-location SIMU-SCHOOL unit, Model I* installed and operating. This unit will be complete with role-playing materials, information materials, computer programs (in conventional, higher-order languages such as FORTRAN or SIMSCRIPT), computer terminals (keyboard terminals, CRT displays, line printers), film projectors, and other elements of the SIMU-SCHOOL stage setting. It will be on-line to a computer. The specifications for computer equipment will be determined in the course of the development program. The Model I equipment configuration will accord with these specifications.

- A relational-data program system (to be developed apart from the programs above) that is operational on the equipment selected for SIMU-SCHOOL and that contains a tested simulation program, ready to be employed by the simulation team. In SIMU-SCHOOL's second year,

*The evolution of SIMU-SCHOOL through Models I, II and III is described in the development plan in the prospectus.

the comput
will be me

- A document
a basic sy
work plan
ing Model

- A document
detailed p
SIMU-SCHOO
materials,
graph, mus
tinuity of

The work require
is shown graphic
leaf). The sepa
sections that fo

F WORK

here will yield these
n month of work:

DL unit, Model I*
This unit will
aying materials,
omputer programs
-order languages
RIPT), computer
inals, CRT dis-
ilm projectors,
e SIMU-SCHOOL
be on-line to a
tions for com-
determined in
pment program.
nfiguration will
ications.

system (to be
programs above)
he equipment
and that con-
n program,
the simulation
second year,

CHOOL through Models
ed in the develop-
ctus.

the computer functions developed for Model I will be merged into this system.

- A document (or set of documents) containing a basic system formulation and a follow-on work plan and management plan for developing Models II and III and their field units.

- A document (or set of documents) containing a detailed plan and budget for operating the SIMU-SCHOOL units, both home and field. These materials, and those of the preceding paragraph, must be prepared in time to insure continuity of funding.

The work required to produce the items named above is shown graphically in the project schedule (overleaf). The separate tasks are described in the sections that follow.

WORK PLAN

PROJECT CO-ORDINATION

As stated above, the division of the project into parts that are geographically separated creates a need for a strong co-ordinating component, one that over the course of the second year will be able to assume full responsibility for developing and operating SIMU-SCHOOL. There will be two main instruments of co-ordination. One will be a set of documented (and continually updated) system specifications, the other a series of system tests to evaluate the work that has been done and indicate changes that must be made. The formulation of system specifications and test plans must be a joint undertaking of all participants in the project, subject to periodic review by a consulting panel. This work is described below as a separate task. The co-ordinating function will include responsibility for evaluating and reporting the results of system tests and for maintaining the extensive documentation needed to keep the system specifications up to date. Another responsibility within this function will be that of planning such other procedures as are necessary to insure that the separate arms of the project move toward common goals.

The task descriptions that follow discuss the work to be done as though it were a unified project, to be carried on by one agency. We repeat for emphasis, no effort is made here to anticipate the division of work among the organizations that participate in the project.

START-UP

A one-month start p
arrange more space,
staff from other ta
ing procedures if n
initiate arrangemen
production of SIMU-

A continuing inform
first month. The e
to simulation techn
programs, to major
pear to bear on, or
and on graphic mate
tially useful in op
important to mainta
materials and to pr
seminating new mate
staff.

FORM A CONSULTATIVE

A consultative pane
work of the project
needed. Funding is
a panel of ten pers
ings. We expect th
select the members
them on SIMU-SCHOOL

project into parts
ates a need for
that over the
e to assume full
rating SIMU-
uments of co-
umented (and con-
ns, the other a
e work that has
ust be made. The
and test plans
rticipants in
ew by a consul-
elow as a sepa-
n will include
orting the re-
ning the exten-
system specifi-
bility within
g such other pro-
at the separate
n goals.

cuss the work to
project, to be
for emphasis, no
division of work
ate in the project.

START-UP

A one-month start period is provided in the plan to arrange more space, as necessary, to move existing staff from other tasks to this one, to initiate hiring procedures if new staff must be obtained, and to initiate arrangements for computer support and for the production of SIMU-SCHOOL materials.

A continuing information search will be started in the first month. The emphasis will be on materials related to simulation technology, to innovative instructional programs, to major social problems or issues that appear to bear on, or stem from, educational programs, and on graphic materials that will be at least potentially useful in operating SIMU-SCHOOL. It will be important to maintain an index or catalogue of these materials and to provide a means for announcing or disseminating new materials to members of the project staff.

FORM A CONSULTATIVE PANEL

A consultative panel will be assembled to review the work of the project staff and provide guidance, as needed. Funding is included in the cost estimates for a panel of ten persons to gather for four two-day meetings. We expect the present SIMU-SCHOOL task force to select the members of this panel. Materials to brief them on SIMU-SCHOOL will be mailed to them by the

FIRST-YEAR SCHEDULE

FOR DEVELOPING SIMU-SCHOOL,

MODEL I

CHEDULE

PING SIMU-SCHOOL,

TASKS

PROJECT COORDINATION ➤

START-UP & LIBRARY ➤

ESTABLISH CONSULTING PANEL ➤

FORMULATE SYSTEM SPECIFICATIONS ➤

ARRANGE ACCESS TO COMPUTER ➤

ADAPT EXISTING SOFTWARE ➤

WRITE COMPUTER PROGRAMS ➤

SELECT COMPUTER CONFIGURATION ➤

PREPARE SCENARIO ➤

PREPARE ROLE MATERIALS ➤

PREPARE INFORMATION MATERIALS ➤

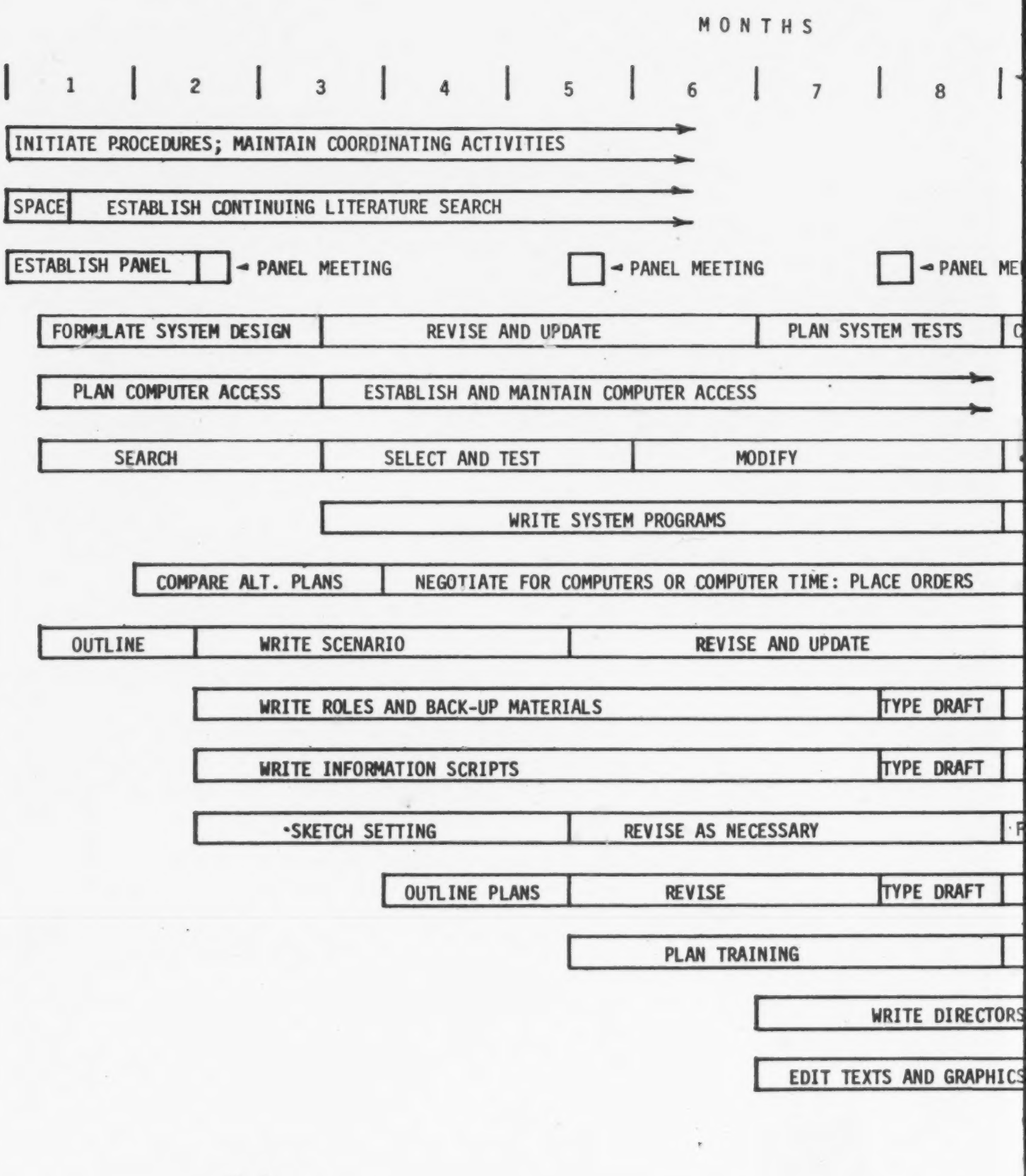
DESIGN & BUILD STAGE SETTING ➤

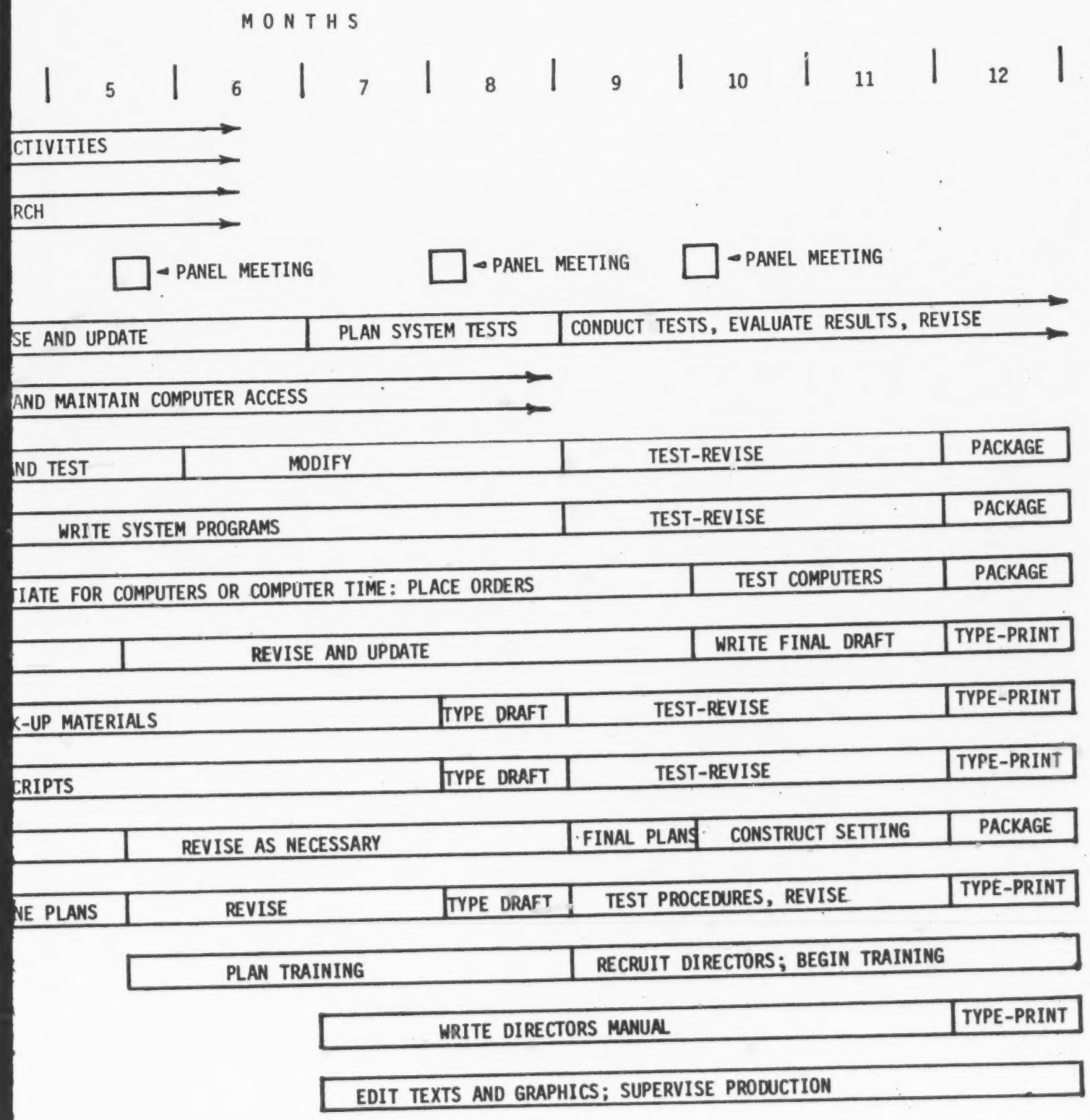
PLAN FIELD OPERATIONS ➤

TRAIN FIELD DIRECTORS ➤

WRITE DIRECTORS MANUAL ➤

EDIT & PRODUCE DOCUMENTS ➤


MONTHS
1
2
3
4
5
6
7
8
INITIATE PROCEDURES; MAINTAIN COORDINATING ACTIVITIES
SPACE
ESTABLISH CONTINUING LITERATURE SEARCH
ESTABLISH PANEL
PANEL MEETING
PANEL MEETING
PANEL ME
FORMULATE SYSTEM DESIGN
REVISE AND UPDATE
PLAN SYSTEM TESTS
PLAN COMPUTER ACCESS
ESTABLISH AND MAINTAIN COMPUTER ACCESS
SEARCH
SELECT AND TEST
MODIFY
WRITE SYSTEM PROGRAMS
COMPARE ALT. PLANS
NEGOTIATE FOR COMPUTERS OR COMPUTER TIME: PLACE ORDERS
OUTLINE
WRITE SCENARIO
REVISE AND UPDATE
WRITE ROLES AND BACK-UP MATERIALS
TYPE DRAFT
WRITE INFORMATION SCRIPTS
TYPE DRAFT
•SKETCH SETTING
REVISE AS NECESSARY
OUTLINE PLANS
REVISE
TYPE DRAFT
PLAN TRAINING
WRITE DIRECTORS
EDIT TEXTS AND GRAPHICS


MONTHS
5
6
7
8
9
10
11
12
CTIVITIES
RCH
PANEL MEETING
PANEL MEETING
PANEL MEETING
SE AND UPDATE
PLAN SYSTEM TESTS
CONDUCT TESTS, EVALUATE RESULTS, REVISE
AND MAINTAIN COMPUTER ACCESS
ND TEST
MODIFY
TEST-REVISE
PACKAGE
WRITE SYSTEM PROGRAMS
TEST-REVISE
PACKAGE
TIATE FOR COMPUTERS OR COMPUTER TIME: PLACE ORDERS
TEST COMPUTERS
PACKAGE
REVISE AND UPDATE
WRITE FINAL DRAFT
TYPE-PRINT
K-UP MATERIALS
TYPE DRAFT
TEST-REVISE
TYPE-PRINT
CRIPTS
TYPE DRAFT
TEST-REVISE
TYPE-PRINT
REVISE AS NECESSARY
FINAL PLANS
CONSTRUCT SETTING
PACKAGE
NE PLANS
REVISE
TYPE DRAFT
TEST PROCEDURES, REVISE
TYPE-PRINT
PLAN TRAINING
RECRUIT DIRECTORS; BEGIN TRAINING
WRITE DIRECTORS MANUAL
TYPE-PRINT
EDIT TEXTS AND GRAPHICS; SUPERVISE PRODUCTION

project team in the third week of the project.

The first panel meeting is tentatively scheduled for the sixth week of the project. The panel will review the initial work plans outlined by the project staff and discuss the direction the work is to take. The next meeting is tentatively set for the middle of the fifth month to review the first complete, detailed formulation of the system plan, to review the components (computer programs role scripts, information scripts) that have been completed to that point, and to review the first outline plans for the ongoing operation of SIMU-SCHOOL. A third meeting at the start of the eighth month is planned to update the panel on the work of the project team and to discuss plans and criteria for system tests. A final meeting, at the start of the tenth month will review the system tests and the details of the SIMU-SCHOOL package that will be delivered at the end of the project year.

We also expect that on-premises consultants will be brought in as need arises, and funds for one full-time-equivalent should be provided for this purpose.

FORMULATE SYSTEM SPECIFICATIONS

This activity is the backbone of the developmental project. It is this work which co-ordinates the other tasks and provides direction for the 3 to 5-year evolutionary program planned for SIMU-SCHOOL. The initial two and one-half months of this task will be devoted to creating a system design for SIMU-SCHOOL, as one might expect it to develop during the third year.

This projected
the project an
emerges, remai
expect that the
in the beginni
head, as exper
emerge. Thus,
always within
serve open-ende
chieve this is
only meet some
amenable to oth
cal design for

Decisions about
on the results
as components o
reason, plannin
in this work pl
the system desi

While this will
elements of the
on the design o
capacities of t
grow, will incr
of SIMU-SCHOOL.

This task is ex
5-year developm
tus. As the en
sign work will
specification f

the project.

vely scheduled for
e panel will re-
ed by the project
e work is to take.
t for the middle
irst complete, de-
lan, to review the
scripts, informa-
eted to that point,
ans for the on-
third meeting at
lanned to update
ct team and to dis-
tests. A final
month will review
f the SIMU-SCHOOL
the end of the pro-

nsultants will be
ds for one full-time-
this purpose.

he developmental
o-ordinates the
for the 3 to 5-
for SIMU-SCHOOL.
hs of this task will
esign for SIMU-SCHOOL,
during the third year.

This projected design is necessary to give direction to the project and to insure that the actual design, as it emerges, remains open-ended and able to grow. One can expect that the third-year design, as it is envisioned in the beginning, will change as the project moves ahead, as experience increases, and as new technologies emerge. Thus, the direction will shift, over time, but always within agreed-upon parameters. The need to preserve open-endedness is paramount, and one way to achieve this is to insist that each design decision not only meet some current need of the system, but also be amenable to other needs, as reflected in the hypothetical design for a system that is three to five years away.

Decisions about design changes will hinge in large part on the results of system tests that will be conducted as components of SIMU-SCHOOL are completed. For that reason, planning tests and carrying them out are seen in this work plan as part of the task of formulating the system design.

While this will be the co-ordinating activity for all elements of the project, we expect that it will focus on the design of the computer system, for the limits and capacities of that system, especially as the capacities grow, will increasingly impact upon the other elements of SIMU-SCHOOL.

This task is expected to continue throughout the 3 to 5-year development program envisioned in this prospectus. As the end of the first year approaches, the design work will evolve into preparing an initial system specification for SIMU-SCHOOL, Model II.

ARRANGE ACCESS TO COMPUTER

This task is concerned with arranging for computer services to support the work of developing SIMU-SCHOOL. It would be desirable if long-term arrangements for computer services could be established early. This may not be possible, especially if the decision is made to purchase equipment for a computer facility. In such a case, arrangements for leased time will have to be established, so that programming work can begin on schedule. This will involve the resolution of questions concerning equipment configurations and programming language. The task must be completed in the first two and one-half months.

The task of deciding upon a permanent computer configuration to support SIMU-SCHOOL, both at home and in the field, is a longer-term activity and will be discussed in a moment.

ADAPT EXISTING SOFTWARE

In the current state of simulation technology, it is a borderline question whether there is merit in attempting to adapt existing software (computer programs and bodies of machine-readable information) to the purposes of SIMU-SCHOOL. Two factors encourage us to investigate the question: one is the increasing use of generalized, higher order languages that permit a given program to operate on different machines and in different applications; the second is the fact that many programs have been developed at government expense and are in the public domain, available at no cost. But there are cautionary factors, too. For instance, even

a program in a highe
written with specifi
capacities in mind,
only on certain con
more, one always fac
exactly what the pro
who proposes to adap
to test it and to re

He must also have h
in hand, before he

The majority of sim
written in a varian
er-level languages.
lation modes are tr
ed for an overnight
entry (RJE) run con
executive. Many of
The programs exist
means that if four
er center, the equi
ies. Some of our r
by Environmetrics,
bytes of core stora
tive program), depe
of plays. We might
the school model fr
SCHOOL, assuming th
program design that

It should be kept i

anging for computer
developing SIMU-SCHOOL.
erm arrangements for
blished early. This
if the decision is
a computer facility.
r leased time will have
ramming work can begin
the resolution of
configurations and pro-
st be completed in the

manent computer con-
OL, both at home and in
tivity and will be dis-

tion technology, it is
there is merit in at-
tware (computer programs
information) to the pur-
tors encourage us to in-
the increasing use of
uages that permit a given
t machines and in dif-
d is the fact that many
t government expense and
lable at no cost. But
too. For instance, even

a program in a higher-order language will have been written with specific input/output devices and storage capacities in mind, and thus may prove to be operable only on certain configurations of equipment. Furthermore, one always faces the problem of finding out exactly what the program will do and how well. Anyone who proposes to adapt existing software, must prepare to test it and to reprogram as necessary.

He must also have his own system program design firmly in hand, before he can do either of these things.

The majority of simulation software existing today is written in a variant of FORTRAN or SIMSCRIPT, two higher-level languages. Almost none of the relevant simulation modes are truly time-shared. Most must be batched for an overnight computer run or for a remote-job-entry (RJE) run controlled by a program called an RJE executive. Many of the latter exist on the IBM 1130. The programs exist in a one-copy-per-user form, which means that if four teams are playing at a given computer center, the equipment must be able to hold four copies. Some of our readers may know the CITY game played by Environmetrics, Inc. CITY takes between 17 and 40K bytes of core storage per copy (exclusive of the executive program), depending on the version and the number of plays. We might point out that certain portions of the school model from CITY II are available to SIMU-SCHOOL, assuming that they prove suited to the system program design that emerges.

It should be kept in mind that this task is partly

exploratory. If easily adapted software is discovered, then the project will have gained an advantage. We assume that this effort will produce enough in the way of programs and data stores, even if modification is required, to repay the labor costs.

WRITE COMPUTER PROGRAMS

The magnitude of this task depends on the language/machine combination that is adopted for SIMU-SCHOOL. Let us assume that we select a machine with an operating or executive system that will 1) support a time-shared or remote-job-entry terminal and 2) support the programming language that is chosen for SIMU-SCHOOL. Given this foundation, the work that remains is to construct the basic system programs for SIMU-SCHOOL (in the SIMU-SCHOOL family of programs, these will be the ones that control the interactions of the others) and the object programs -- the programs that the user encounters. But if the choice of language and machine does not afford an operating system, then that system, too, must be programmed. This may more than double the workload.

Earlier in this prospectus, we recommended that the REL (Rapidly Extensible Language) developed at California Institute of Technology be adopted for SIMU-SCHOOL. We also recommended the use of mini-computers. The flexibility and the potential for expansion in this combination are unmistakable. But the market at present offers no mini-computer with an operating system that will support REL. Thus, the project, if the recommendation is adopted, will face the larger programming task.

If the sponsors of SIMU-SCHOOL decide to accept the

limitations of mo
languages such as
we estimate that
tion work would b

Our schedule show
in the middle of
that an important
incorporated in t
earlier. Thus, t
sign, programming
point where syste
endar months.

SELECT COMPUTER C

This task is conc
for both the home
eral feasible arr
gated. Cost diff
quiries, appear t
that the annual c
$15,000 - $30,000
chosen.

Portions of the p
figuration that a
examination, best
terested reader, w
tion on selecting
sion of the alter

For comparison, le
uration that we ha

ted software is discovered,
ained an advantage. We
produce enough in the way
even if modification is re-
osts.

epends on the language/mach-
ted for SIMU-SCHOOL. Let
achine with an operating or
) support a time-shared or
d 2) support the programming
SIMU-SCHOOL. Given this
emains is to construct the
IMU-SCHOOL (in the SIMU-SCHOOL
ll be the ones that control
rs) and the object programs --
ncounters. But if the choice
s not afford an operating sys-
must be programmed. This may
d.

we recommended that the REL
e) developed at California
dopted for SIMU-SCHOOL. We
mini-computers. The flexi-
r expansion in this combina-
the market at present offers
rating system that will sup-
t, if the recommendation is
er programming task.

OOL decide to accept the

limitations of more conventional languages than REL-languages such as FORTRAN, SIMSCRIPT, or BASIC - then we estimate that the programming and system-formulation work would be reduced 50% or more.

Our schedule shows the writing of programs starting in the middle of the third month. We should point out that an important part of the programming effort is incorporated in the system-formulation task described earlier. Thus, the total time allowed for system design, programming, and program checkout, up to the point where system tests begin, is nearly eight calendar months.

SELECT COMPUTER CONFIGURATION

This task is concerned with planning computer support for both the home and field units of SIMU-SCHOOL. Several feasible arrangements exist and must be investigated. Cost differences, to judge by our initial inquiries, appear to be minor. The evidence suggests that the annual cost per unit will fall in the range $15,000 - $30,000, no matter which arrangement is chosen.

Portions of the prospectus describe the equipment configuration that appears, on the strength of our initial examination, best suited to SIMU-SCHOOL. For the interested reader, we shall devote the rest of this section on selecting a computer configuration to a discussion of the alternatives that we considered.

For comparison, let us recall for a moment the configuration that we have favored. The main component is a

fully dedicated mini-computer installation at a national center that serves all units. Each unit contains several kinds of terminal equipment, plus a monitor or scheduler to control the transfer of information between the unit and the central computers. What are the alternatives?

One is to arrange with an existing computer center to provide time-shared service to all SIMU-SCHOOL units in the nation. Here, the SIMU-SCHOOL users would share the system with many others. Another is arrange with existing regional centers to serve SIMU-SCHOOL units in their areas, again through time-sharing with other users. Another is to employ wholly independent mini-computer installations, one for each unit, home or field. The field units would be mobile.

From the consideration of these alternatives, certain minimal hardware characteristics emerge:

- Selected hardware must have a manufacturer-supplied operating system to support the language selected for SIMU-SCHOOL, or co-operation of the manufacturer must be obtained to develop an operating system.

- The selected equipment must be capable of supporting two to twenty terminal input/output channels at rates up to 2400 baud.

- Selected equipment must support a common high-order programming language, such as FORTRAN IV, COBOL, BASIC.

installation at a nation-
s. Each unit contains
pment, plus a monitor or
fer of information be-
computers. What are

ting computer center to
all SIMU-SCHOOL units
-SCHOOL users would share
Another is arrange with
erve SIMU-SCHOOL units
time-sharing with other
holly independent mini-
r each unit, home or
be mobile.

se alternatives, certain
ics emerge:

ve a manufacturer-
em to support the
IMU-SCHOOL, or co-
cturer must be ob-
erating system.

st be capable of
y terminal input/
s up to 2400 baud.

upport a common
language, such as
C.

- Equipment selected for mobile units must have wide-spread national service/support personnel available.
- Equipment selected for mobile units must not impose special requirements for temperature or humidity.
- Independent mobile units must possess easily expanded bulk storage.
- A hardware storage-protect feature is highly desirable. If transmissions to a central computer are involved, then error detection and correction codes are necessary.
- The selected equipment must be compatible with standard transmission logics -- the American Standard Code for Information Interchange or the Extended Binary Coded Decimal Interchange Code.
- Mobile equipment and programs should permit emulation on one of the following systems: IBM S/360, Univac 1108, Burroughs 5500, or CDC 6600.
- Minimum requirements for a regional center computer must include programming language compatibility and equipment compatibility.
- Mobile configurations must be capable of full operation on standard 110-115 volt or 220 volt

electrical supply.

Here are notes on some of the conventional system configurations that we examined:

Mobile, Van-Delivered, Self-Contained, Computer-Based System: $1,200 - $1,500/Month

- Two hard-wired terminals similar to the Model 33 teletype or selectric typewriter.
- One operator terminal.
- 12-16K bytes of core.
- Fast access disk inventory.
- Magnetic tape or replaceable disk storage.
- BASIC or FORTRAN IV compiler.

Examples of suitable equipment:

- Digital Equipment Corporation PDP-11/24 with 8K core (16K bytes) IBM 1134 compatible FORTRAN, RC11/RS64 disk memory (65,536 words per RS64; expandable to 262K words; i.e., 524K bytes), TU56 magnetic tape transport (puts two reels of 262I bytes of data on line at 10KC rate). Cost approximately $1,200 to $1,500 per month on a five year, full pay out lease (per unit).

conventional system
d:

tained, Computer-
Month

milar to the
ectric type-

le disk stor-

er.

:

ion PDP-11/24
IBM 1134 com-
64 disk memory
expandable to
ytes), TU56
(puts two reels
line at 10KC
ly $1,200 to
ve year, full
.

- IBM system/3 model 10 with 12K core (bytes), FORTRAN IV compiler, operator terminal, card reader/printer operating system, RPG-II data utility, 5444 disk storage (2,457K bytes) T/S exec. Cost approximately $1,500 to $1,700 per month.

- Two Model 33 ASR (Automatic Send and Receive) teletype terminals or Datel 707 selectric typewriter terminals, hard wired, approximately $70 to $134 per month each.

Both examples of equipment could be packaged to fit in a standard micro-bus, per Volkswagen, Ford, Dodge, etc. Consideration could also be given to a small truck or van arrangement.

Regional Centers: University Centers Having Existing Time-Shared or Remote-Job-Entry Systems Operational:

A major difficulty is defining a common system over a variety of schools. Another is defining the unit cost of computer time. The majority of the university centers say they operate on a no-loss, no-profit basis and the costs are pro-rated among users. In short, the cost varies with system use and the number of system users.

In the commercial market in the Washington, D.C. area, IBM S/360-65 time goes for $175.00 to $500.00 per hour depending upon shift and volume. This is a batch rate based on 512K core, tapes and disks. Commercial T/S rates are charged on a combination of monthly minimum, CPU costs per-second, storage costs on a daily or per-thousand character basis and per-hour connect time

charge. Here are some examples of time-shared rates (data as of Fall, 1970).

Vendor	IBM CALL/ 360 BASIC	GE Info.	NIH
Monthly Min.	$100	$100	$0
Terminal Con.	$7-$11 per hr	$10/hr	$4.40/hr
CPU	$0	$2.40/min	$22/hr
Storage	1.10/34K bytes	2/1500 char	0.45/7300 bytes/mo

Vendor	Bolt, Beranek and Newman	ITT Data Services	McDonnell Automation
Monthly	$0	$150	$100
Terminal	$12	$12-$20	$10/hr
CPU	$0	$5	$0.05/sec
Storage	$0	$9/mo per 30K bytes	$2.50/unit (134K bytes)

We believe that an average estimate of $10/hour connect time, $30/hour CPU time and no charge for storage or monthly minimum, would be a fair guess for user costs.

The following list identifies a set of time/share university centers and their equipment. We do not know what the various charge schemes are.

Pacific/West Coast Time Zone

S/360	U.C.L.A., Stanford, Washington State University
B-5500	University of Washington

Mountain

S/360

B-5500

UNIVAC

SPECTR

Central T

S/360

B-5500

UNIVAC

Eastern T

S/360

B-5500

UNIVAC

GE-635

of time-shared rates

Info.	NIH
00	$0
10/hr	$4.40/hr
2.40/min	$22/hr
1500 char	0.45/7300 bytes/mo

	McDonnell Automation
	$100
	$10/hr
	$0.05/sec
er	$2.50/unit
tes	(134K bytes)

mate of $10/hour connect
charge for storage or
r guess for user costs.

set of time/share uni-
ment. We do not know
are.

ford, Washington State

Washington

Mountain States

S/360	U.C.L.A. Center services both Pacific and Mountain time zones
B-5500	University of Denver
UNIVAC 1108	University of Utah
SPECTRA 70	Oklahoma City (possibly a commercial center now.)

Central Time Zone

S/360	University of Michigan, Baylor, Purdue
B-5500	University of Illinois
UNIVAC 1108	SMU

Eastern Time Zone

S/360	University of Pennsylvania, USOE, MIT, NIH
B-5500	Georgia Tech
UNIVAC 1108	Georgia Tech
GE-635	Dartmouth

Regional Centers: Federal Centers With Time-Sharing or Remote-Job-Entry Systems Operational:

Another possibility exists in the use of federal centers, so long as they continue to have USOE support. The Atomic Energy Commission has five centers which provide time on an as-available basis. Each of the ten General Services Administration regions has an Inter-Agency ADP Co-ordinator whose job it is to keep track of who has what hardware/services available. The prices for services are negotiable within each region with the supplier. The East Coast uses a GE-440 in Atlanta for its T/S services. The AEC S/360-75 in Idaho Falls is used by a host of Western and Mountain States agencies. We have requested additional data about these facilities and the regulations appropriate to their use.

As can be seen, a common set of equipment with common capabilities is almost non-existent. We would guess that each new/different system that was introduced into a regional scheme could mean an extra six man months in development/modification, installation time.

National Center: Supporting 1 to 16 Sets of Games Simultaneously

Almost any of the G.S.A. Centers, university centers or commercial houses could handle the problem, if the sponsors of SIMU-SCHOOL elect a conventional system. In each case, the development time would be spent building the model rather than building the model and the T/S exec. Potential problems exist due to user load seriously affecting response time and the time

zone differe

Telephone ra
leased line

Up to two
Over two

Direct dista

Up to 250

250 Miles

Over 1,00

PREPARE A SC

In the genera
rents are dis
point) is di
ments of SIMU
SCHOOL's inst
the general p
instructiona
fies problems
the roles to
be used; spec
stage-setting
to various in

enters With Time-Sharing
Operational:

n the use of federal cen-
ue to have USOE support.
has five centers which
able basis. Each of the
stration regions has an
or whose job it is to keep
are/services available.
negotiable within each
The East Coast uses a GE-
services. The AEC S/360-
a host of Western and
We have requested addi-
ilities and the regulations

t of equipment with common
existent. We would guess
tem that was introduced in-
mean an extra six man months
installation time.

g 1 to 16 Sets of Games

nters, university centers
handle the problem, if the
ct a conventional system.
nt time would be spent
han building the model and
oblems exist due to user
sponse time and the time

zone difference.

Telephone rates for a 2,000 bit/second unconditional leased line can be estimated as follows:

Up to two thousand miles	$2.50/mile/month
Over two thousand miles	$3.00/mile/month

Direct distance dial, day time rate, station to station:

Up to 250 Miles	$0.80 1st 3 min. .20 for each successive period
250 Miles to 1,000 Miles	$1.40 1st 3 min. .35 each successive period
Over 1,000 miles	$1.75 1st 3 min. .45 each successive period

PREPARE A SCENARIO

In the general work plan for SIMU-SCHOOL, two main currents are discernable. One (our main topic to this point) is directed to building the computerized elements of SIMU-SCHOOL. The other is directed to SIMU-SCHOOL's instructional technologies. The scenario is the general plan that defines and co-ordinates the instructional aspects of SIMU-SCHOOL. This plan specifies problems to challenge the participants; defines the roles to be played and the information sources to be used; specifies the instructional media and the stage-setting for SIMU-SCHOOL; guides participants into various interactions among themselves and with the

computer; prescribes the data files to be incorporated in the computer system; and indicates the skills and training needed by unit directors.

Like the overall system design formulated through work described earlier, the scenario will be both a governor and a mirror of events. It can be expected to grow and change as the instructional aspects of SIMU-SCHOOL mature. We have already discussed the SIMU-SCHOOL scenario in the prospectus that accompanies this work plan. We expect the preparing and updating of the scenario to be a continuing activity.

PREPARE ROLE MATERIALS

The number and kind of roles to be played by the participants in SIMU-SCHOOL will be determined as the scenario is written. A participant may find himself cast as a parent, a teacher, a member of a minority group, a public official, and so on. In certain SIMU-SCHOOL situations, he will be given very specific information about viewpoints that he is to express and positions he is to take. He will also be provided with a pamphlet of background information about the role that he is to play -- information about this imaginary person's education, his family background, his hopes, his fears, his financial status, and so on. This will permit the participant to expand on his role, if he wishes, and to take stands and defend positions with greater vigor and certainty, even in situations where specific instructions are not provided.

We expect that eventually SIMU-SCHOOL will employ as

many as thirty
fewer. In som
may be asked t
materials will
tions, plus a
working instru
puter's data b
will take two
for revision o

PREPARE INFORM

To the greates
upon the parti
which SIMU-SCH
will include i
SCHOOL. It wi
issues and pro
of Everywhere,
bout new educa
adopted in oth
planning techn
to employ.

Each participa
"expert" on on
teacher. Note
rate from the
conflict and d

To help him in
will be given
slides or mate

s to be incorpor-
ndicates the skills
ors.

rmulated through work
ll be both a governor
expected to grow
pects of SIMU-SCHOOL
the SIMU-SCHOOL
companies this work
updating of the
ty.

e played by the parti-
termined as the sce-
may find himself cast
of a minority group,
certain SIMU-SCHOOL
specific information
press and positions he
ided with a pamphlet
he role that he is to
aginary person's edu-
s hopes, his fears,
This will permit the
, if he wishes, and
ns with greater vigor
where specific in-

HOOL will employ as

many as thirty roles. Model I will no doubt have fewer. In some case, several persons, as a group, may be asked to represent a given role. The role materials will consist of a set of working instructions, plus a background pamphlet. Certain of the working instructions will be incorporated in the computer's data base. Preparing materials for one role will take two to four weeks. System tests will call for revision of many of these materials.

PREPARE INFORMATION MATERIALS

To the greatest extent possible, SIMU-SCHOOL will call upon the participants to present the information upon which SIMU-SCHOOL operates. This body of information will include instructions for participating in SIMU-SCHOOL. It will include information about the social issues and problems that beset the hypothetical city of Everywhere, U.S.A. It will include information about new education programs that have been tried or adopted in other communities. Or information about planning techniques that the participants might wish to employ.

Each participant thus becomes a resource person -- an "expert" on one subject or another. He becomes a teacher. Note that this assignment can be quite separate from the role that he will be asked to play in conflict and decision situations.

To help him in his assignment as a teacher/expert, he will be given a script and a set of visuals -- 35mm slides or materials suited to an overhead projector.

The script will enable him to talk perhaps five or six minutes. He will also be given a background pamphlet that will help him answer questions on his subject in some depth. The script will be so structured that he can employ it verbatim, or insert his own words. In the opening session of SIMU-SCHOOL, the participants will be given approximately one hour to review these materials. If the community sponsors of SIMU-SCHOOL wish, these materials can be provided in advance, so that participants can prepare themselves more thoroughly. The point is, that these materials must be solid in content and well-prepared. We expect a sizeable library of such materials to develop as SIMU-SCHOOL grows.

The first year's output of these materials will be small and will have to be heavily supplemented by instructions and guidance from the unit director when Model I is in operation. We estimate that the preparation of a script and its accompanying visuals and background pamphlet will require one man/month.

DESIGN AND BUILD THE STAGE SETTING

We cannot overemphasize the importance of the visual setting. The impact must be unmistakable. The sense of place must be pervasive -- of a very special place where people have come to engage in new and exciting and important work. The setting must be solid and architectural in feeling, yet be modular to fit rooms of various sizes and shapes. It must be portable. Color will be important. The use of various instructional aids and of visual displays must be integrated with the total design.

Arrangements
setting must

We assume tha
can be called
sign of the s

PLAN FIELD OP

This task wil
SCHOOL develo
It will be ne
expected to a
of them as po
or micro-buse
then the fitt
as part of th
earlier will
(the design o
and it will b
signed to thi
represented i
procedures fo
of this task.
plan and budg
to support re
units in the
gins at the e

TRAIN FIELD D

The need for
the third yea
ning for them

rhaps five or six
kground pamphlet
n his subject in
ructured that he
own words. In
he participants
to review these
of SIMU-SCHOOL
in advance, so
ves more thorough-
ls must be solid
ect a sizeable
as SIMU-SCHOOL

rials will be
plemented by in-
director when
that the pre-
ying visuals and
man/month.

e of the visual
able. The sense
ery special place
ew and exciting
be solid and
ular to fit rooms
be portable.
various instruc-
ust be integrated

Arrangements for packaging and transporting the stage setting must also be provided for in the design.

We assume that the American Institute of Architects can be called upon for major contributions to the design of the setting.

PLAN FIELD OPERATIONS

This task will be concerned with insuring that SIMU-SCHOOL develops in a form suited to field operations. It will be necessary to identify problems that can be expected to arise in the field and seeing that as many of them as possible are resolved in advance. If vans or micro-buses are to be used for field operations, then the fitting-out of these vehicles must be planned as part of this task. A number of other tasks described earlier will have implications for the field operations (the design of the SIMU-SCHOOL setting, for example), and it will be the responsibility of the person(s) assigned to this task to see that field needs are fully represented in the planning. Support or administrative procedures for field operations must be outlined as part of this task. By the end of the eighth month, a working plan and budget for field operations must be complete, to support requests for funds to start building field units in the course of the second year. This task begins at the end of the third month.

TRAIN FIELD DIRECTORS

The need for field-unit directors will not arise until the third year (perhaps late in the second), but planning for them must begin much earlier. We assume that

SIMU-SCHOOL's field-unit directors will have had prior training in group processes and in instructional technologies, particularly simulation technologies. Because the action in SIMU-SCHOOL is open-ended, the director must be resourceful and creative. He must also have a thorough knowledge of SIMU-SCHOOL, so that he can select from its many elements those of greatest impact for a given situation and bring them into play. Thus, an effective training program is necessary.

We believe that a year's participation in the development of SIMU-SCHOOL would afford the best possible training for the unit director. This would not only give him experience of inestimable value, it would also give him a proprietary interest in SIMU-SCHOOL and do much to offset the we-they conflict that so often arises between home offices and field operations. In short, the staffing of the SIMU-SCHOOL development program should be arranged with some thought to providing directors for the field units.

There are many aspects of field operation that cannot be touched upon in the development program, and so special training must be provided. Initial planning for the training program must be begun as soon as the basic planning for the field operations begins to take shape. Time must also be allowed for recruiting field directors specifically for this job in the event that they cannot be found among the development staff. Our tentative schedule shows this work starting in the fifth month.

WRITE A DIRECTORS M

Careful and comple
operating procedure
that all the tasks
materials to the ma
ganized and indexe
written.

EDIT AND PRODUCE D

The documents used
other public relea
must all the graph
Controlling and ov
quire a qualified
join the project i

WRITE A DIRECTORS MANUAL

Careful and complete documentation of SIMU-SCHOOL's operating procedures will be mandatory. We expect that all the tasks so far enumerated will contribute materials to the manual. These materials must be organized and indexed. Much new text will have to be written.

EDIT AND PRODUCE DOCUMENTS

The documents used in the SIMU-SCHOOL exercises and in other public releases must be of excellent quality, as must all the graphic materials employed in SIMU-SCHOOL. Controlling and overseeing their production will require a qualified person. A full-time editor should join the project in the sixth month.

COSTS

LABOR COSTS FOR DEVELOPING SIMU-SCHOOL

We estimate that approximately 180 man-months of effort will be necessary in the first year to accomplish the work described in the preceding sections of this document. At the year's end, the technical-professional-managerial staff would number 16-18 persons. Secretarial and clerical people are not included in this estimate. In very broad terms, we see the work effort falling into two major areas of expertise:

Computer Technology	80 man-months
Instructional and Simulation Technology	100 man-months

The estimate of 180 man-months was arrived at by analyzing the tasks outlined in this document in some detail. The analysis is not published here, on the recommendation of the members of the SIMU-SCHOOL consulting panel, in order to give potential contractors greater freedom in formulating their own work plans and cost proposals. The panel further advised against expressing the work estimate in dollars, pointing out that different overhead rates make it difficult to produce budget estimates without thinking in terms of specific contractors. There is also the very practical question of the impact of available funds on the scheduling of work and on the size of the effort in a given fiscal year.

OTHER DIRECT COSTS

Subject to the pr
project may chang
to labor and over

Travel: $28,000.

puter programs.
full-time travel

Materials: $50,00

manuals, and othe
exercises; the SI
equipment.

Computer Support:

Consulting Panel:

meetings.

On-Premises Consu

plus limited per-
and travel.

OOL

man-months of ef-
year to accomplish
sections of this
echnical-profes-
r 16-18 persons.
not included in
, we see the work
of expertise:

man-months

man-months

arrived at by ana-
ocument in some
hed here, on the
e SIMU-SCHOOL con-
ential contractors
r own work plans
her advised against
lars, pointing out
it difficult to
inking in terms
also the very prac-
ilable funds on
ize of the effort

OTHER DIRECT COSTS FOR DEVELOPING SIMU-SCHOOL

Subject to the proviso that the size or nature of the project may change, the following costs (in addition to labor and overhead) have been estimated:

Travel: $28,000. Primarily for data gathering and the investigating of existing computer programs. Assume one and one-half persons in full-time travel status, plus per-diem and fares.

Materials: $50,000. For film slides, other visuals; printing costs for role materials, manuals, and other texts; forms used in the SIMU-SCHOOL exercises; the SIMU-SCHOOL stage setting; audio-visual equipment.

Computer Support: $24,000. Computer services for nine months for one location.

Consulting Panel: $20,000. Stipends, travel, and per-diem for ten persons, four meetings.

On-Premises Consultants: $45,000. Equivalent of one full-time person, plus limited per-diem (some consultants will be local) and travel.

ANNUAL COSTS OF OPERATING A SIMU-SCHOOL
UNIT IN THE FIELD

Staff: Three persons: a director, an assistant director, and a staff member, the latter carrying secretarial/clerical duties, but also able to assist in the SIMU-SCHOOL exercises. Plus overhead.

Computer Support: $30,000 yearly.

Other Costs: $20,000 yearly. Covers the cost of forms and other exercise materials, annual cost of a van, costs of packing and moving.

Travel: $5,500. Fares and per-diem for six trips to the SIMU-SCHOOL Center.

SINS-SCHOOL Task Force of the Committee on Architecture
for Education, American Institute of Architects

Donald F. Burr, A.I.A., Chairman
Tacoma, Washington

James A. Cheek, A.I.A.
Dallas, Texas

SIMU-SCHOOL

•• a tool and process for educational planning

July 1971

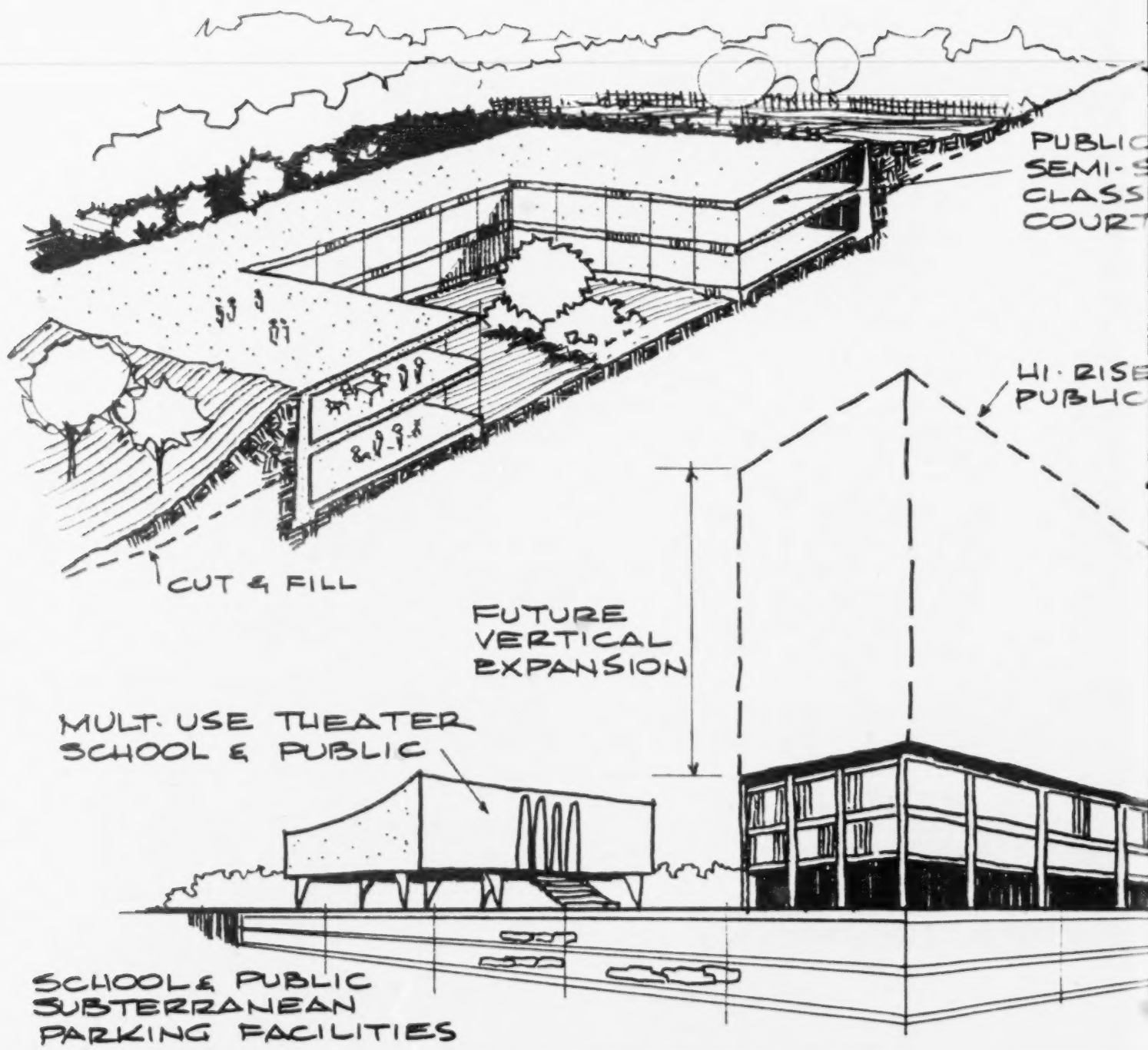
This prospectus has been written in response to many requests for information. SIMU-SCHOOL does not yet exist. Funds are being sought for its development.

This is an interim report -- not the final product.

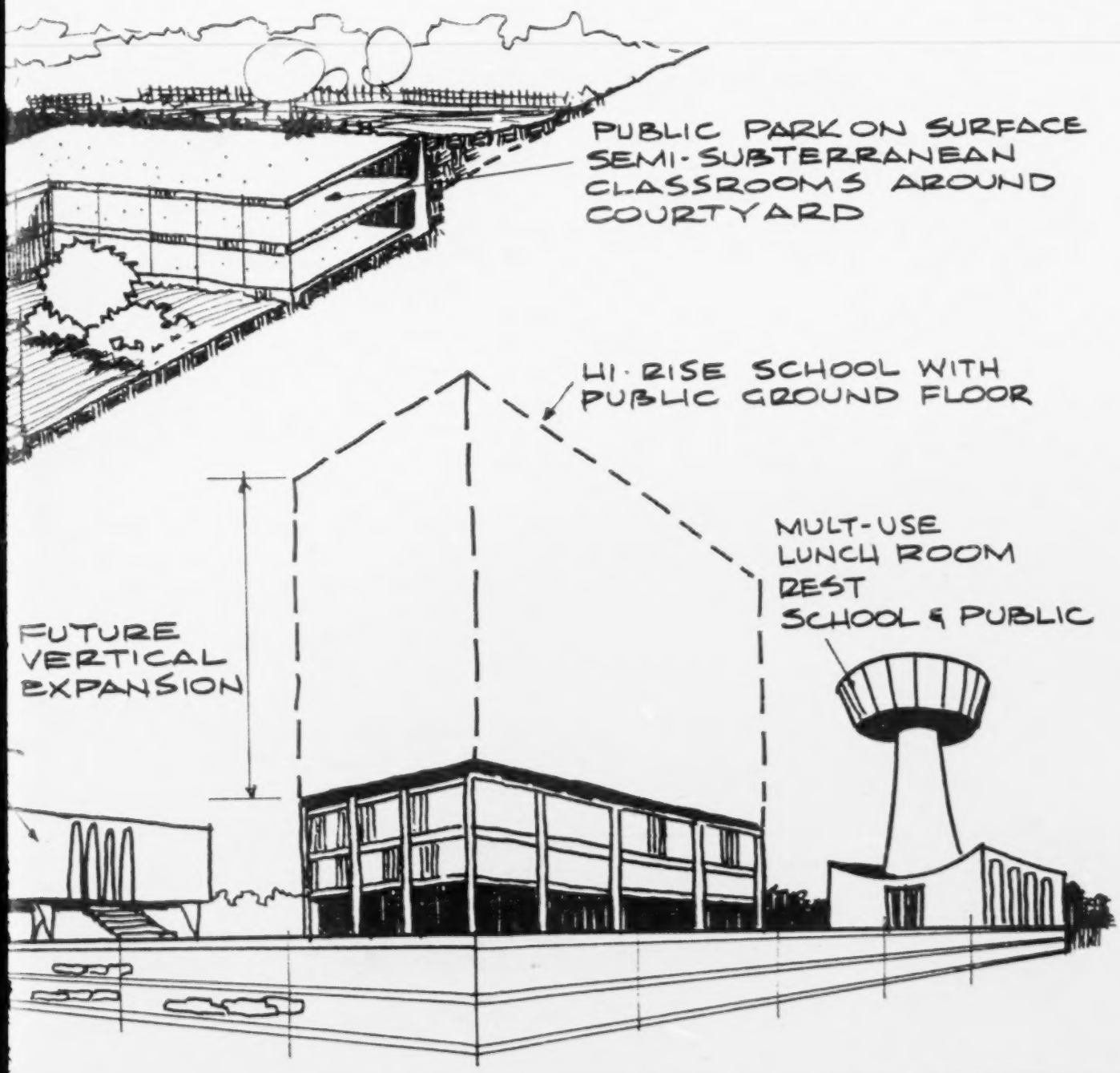
Printed by the Chicago Board of Education
in cooperation with
The Council of Educational Facility Planners

TABLE OF CONTENTS

INTRODUCTION AND SUMMARY	1
PROBLEMS, NEEDS, OPPORTUNITIES	4
SIMU-SCHOOL: OVERVIEW, PARTICIPANTS, GOALS	10
DEVELOPMENT PLAN AND ORGANIZATION	20
APPENDICES	
APPENDIX I: THE PLANNING PROCESS	25
APPENDIX II: THE SIMULATION PROGRAM	28
APPENDIX III: THE SIMULATION TECHNOLOGY	36



SECTION ONE INTE



SECTION ONE INTRODUCTION AND SUMMARY

SIMU-SCHOOL

RATIONALE

This is a time of crisis in American education: A crisis in quality, a crisis in cost, a crisis in change. Chasms of bitterness are opening. On one side stand those who operate the schools; on the other, those who use the schools and pay for them.

What is needed? A way or process to establish sympathetic dialogue between school people and the public, for one thing. A tool to help them devise better forms of education, for another.

CONCEPT

An instrument to address those needs is described here. It is called SIMU-SCHOOL. It is a simulation of the school-planning process, designed to bring persons from all walks of life into that process and to introduce them to techniques and information that will help them create new forms of education for their community.

SOURCE OF THE CONCEPT

SIMU-SCHOOL was conceived by members of the Committee on Architecture for Education of the American Institute of Architects, in co-operation with various educators and educational organizations. The project is one in a series of public-interest activities of the Committee. A task force of the Committee has provided leadership in development of SIMU-SCHOOL and raising funds for preliminary design. Grants to cover part of the costs of preparing this prospectus were awarded by the U.S. Office of Education and the Educational Facilities Laboratory, Inc.

The American Institute of Architects task force worked in close co-

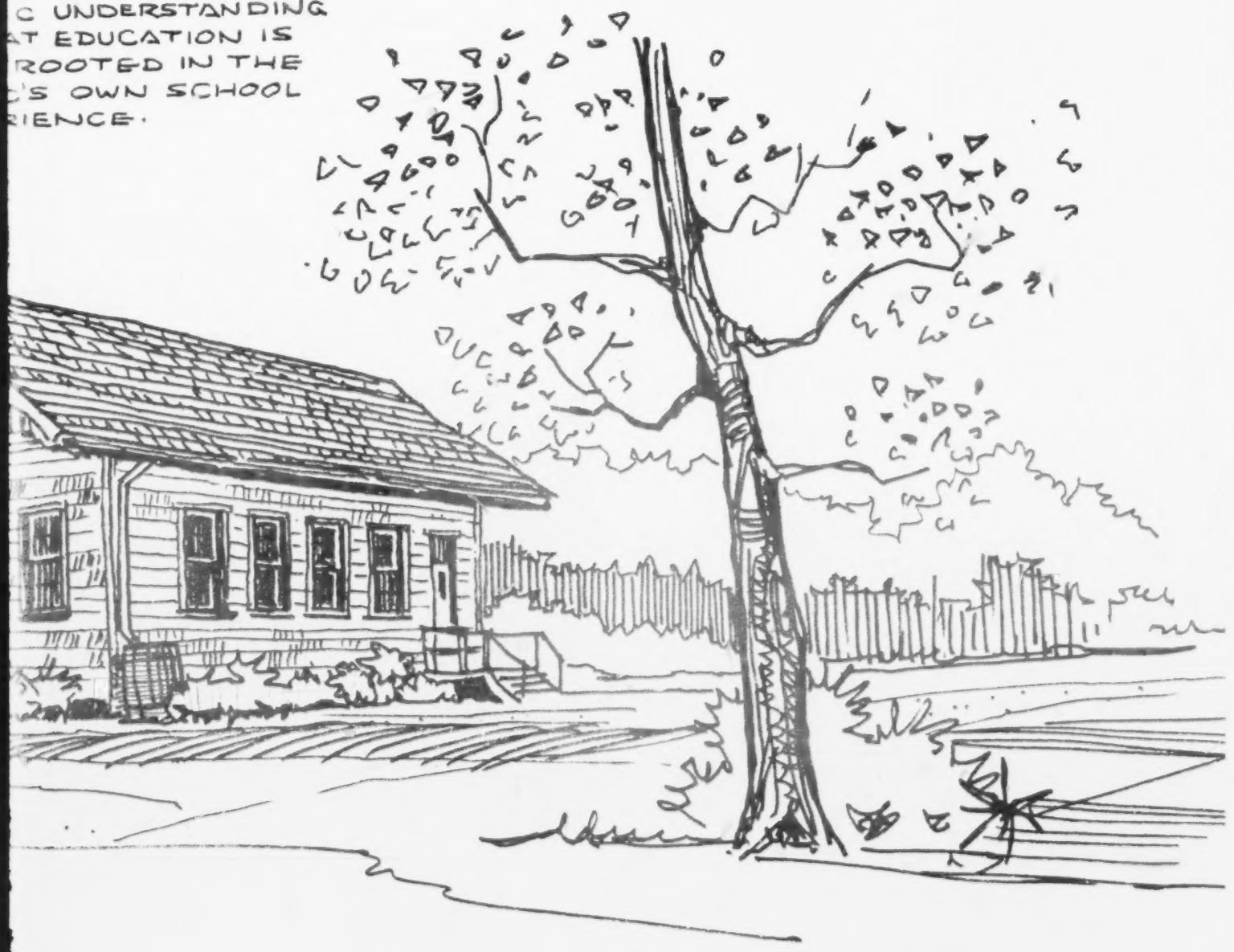
ordination with a consulting panel of 10 persons prominent in education and architecture. These consultants are some of the most capable educational planners in America. All those involved have given time, effort, and money far beyond the value of the formal grants that have so far been awarded. The task force engaged the services of Technomics, Inc. to receive the data developed and prepare the material for this prospectus.

STRUCTURE OF THE PROSPECTUS

The next section of this prospectus discusses the problems, needs, and opportunities to which SIMU-SCHOOL is addressed. Section Three provides an overview of SIMU-SCHOOL, its participants, and its goals. Plans for developing and managing SIMU-SCHOOL are sketched in Section Four. The overview in Section Three only summarizes the operations and technologies of SIMU-SCHOOL. Additional information on these topics appears in Appendices.

SECTION TWO PROB

C UNDERSTANDING
AT EDUCATION IS
ROOTED IN THE
'S OWN SCHOOL
RIENCE.



ECTION TWO PROBLEMS, NEEDS, OPPORTUNITIES

PROBLEMS: A BRIEF REVIEW

PROBLEMS OF MISSION

Past goals and priorities set for our schools ha
us to cope with the emerging critical problems o
poverty, destruction of the environment, the thr
famine, violent divisions of society, crime, dru
of stress, and new forms of involvement in decis

Nor are we schooled to cope with rapid change.
central fact of our time. Our children must be
in the 21st Century -- a world that we cannot fo
condition testifies that traditional forms of ed
our children.

PROBLEMS OF QUALITY

Too often we find bored, apathetic children, the
and enthusiasm stifled, their unique skills unta
is underscored by the occasional room, often of
children are alert, eager to learn.

Some children emerge from our schools barely ab
solve the simplest problems in arithmetic.

Many schools inadequately serve children of spe
speak different languages, whose homes offer fe
who are deficient in hearing or sight, or who s
or the emotional ravages of poverty.

PROBLEMS OF COST

In ten years, the costs of education in the Uni
nearly doubled -- from $31.7 billion in 1960-61
(projected) in 1970-71.

The public attitude is clear. The fate of bond

Past goals and priorities set for our schools have not enabled us to cope with the emerging critical problems of our time: war, poverty, destruction of the environment, the threat of world-wide famine, violent divisions of society, crime, drugs, the illnesses of stress, and new forms of involvement in decision making.

Nor are we schooled to cope with rapid change. Yet change is the central fact of our time. Our children must be readied for life in the 21st Century -- a world that we cannot foresee. Our own condition testifies that traditional forms of education will fail our children.

Too often we find bored, apathetic children, their natural curiosity and enthusiasm stifled, their unique skills untapped. This condition is underscored by the occasional room, often of scant means, where children are alert, eager to learn.

Some children emerge from our schools barely able to read, write, or solve the simplest problems in arithmetic.

Many schools inadequately serve children of special needs -- those who speak different languages, whose homes offer few learning experiences, who are deficient in hearing or sight, or who suffer from malnutrition or the emotional ravages of poverty.

In ten years, the costs of education in the United States have nearly doubled -- from $31.7 billion in 1960-61 to $60.3 billion (projected) in 1970-71.

The public attitude is clear. The fate of bond issues and other

funding referenda in the last four years demonstrates that the purse is closing. Taxes have become a major political issue. In many communities, public concern over school costs has led to budget cuts, without regard to the impact on quality.

The curtailment of funds results in the further decay of old facilities and the postponing of new ones, however badly needed; and in the closing of programs addressed to children of special needs.

PROBLEMS IN PLANNING

In every community, one can find educators and laymen alike who perceive these problems and are deeply concerned. Nor are we ignorant of ways to do better. The tested options grow in number daily: for instance, the use of free-flowing space in buildings, new construction-management techniques to control building costs, the exercise of air rights to enable schools to share expensive land with other users, the use of teaching aides and mini-teachers (children teaching children), work-study programs, the use of whole communitites as teaching/learning resources. And so on.

But only here and there do we find such options being exercised. What forces militate against them elsewhere? Certain forces can be identified:

- Traditional forms of government and school administration cannot produce timely diagnoses of problems or timely responses. The pace of change in society swamps the official structure and its procedures. Those charged with planning lack staff, time, and facilities for their mission.

- The public has not clearly defined new goals and priorities for its schools. Public understanding of what education is,

how it works, what can be expected of it, and how it should be administered is rooted in the public's own school experience. Tradition enjoys a decisive hold.

- There is no mechanism apart from the overworked bureaucracy for weighing issues and resolving conflict. When one segment of a community voices dissatisfaction with schools, others defend the status quo or demand different changes.

- Thus our responses to educational problems are reactive. Intrenched interests and pressure groups force ad hoc solutions to single problems. This creates new problems that demand response. There are neither opportunities nor resources for thoughtful planning.

FOR BETTER PLANNING: THREE NEEDS

The problems of mission, quality, and cost cannot be solved until we first address the planning problems. From the brief analysis of the latter just offered, three primary needs can be inferred:

COMMUNITY PARTICIPATION

Widespread community participation in the educational-planning process is a paramount need. Community participation will --

- Facilitate the redefining of public goals for education.

- Speed the analysis of problems and the weighing of alternatives.

- Open channels of communication, so that common understanding of problems and solutions can be developed.

- Increase community understanding and support.

- Open alternative means for weighing issues and resolving conflict.

SKILLS Before one can participate effectively in educational planning, he must possess certain skills. He must be able to --

- Find his way about in the educational establishment.
- Define problems and establish priorities.
- Put aside long-held ideas and attitudes and become inventive. (This is an essential skill if he is to recognize his options.)
- Devise tests to compare options and their costs.
- Gather, handle, and evaluate forbidding amounts of information.
- Find out what tools are available to help him plan (the inventory grows daily) and learn to use those tools.
- Work with other people of divergent experience, different vocabularies, and conflicting views.

TOOLS Among the tools that the planner will need are these:

- Teaching/learning tools that will help him acquire and sharpen the skills just named.
- Information - information about the planner's community, about new forms of education, and about planning technology. (A means for pulling together these now-scattered bodies of information is a major need.)
- Data-processing tools that will help him gather, store, retrieve, and use the quantities of information that he must work with.

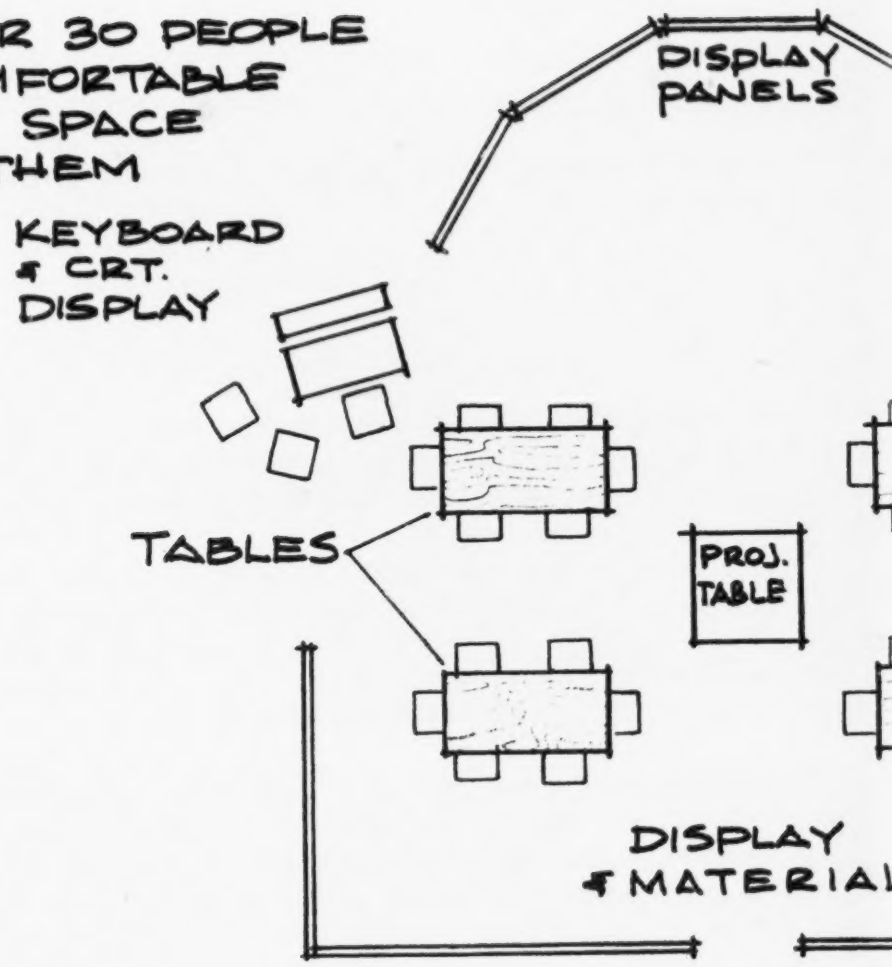
- Tools to assist in the display and communication of ideas and information.
- Tools that will help him build still other tools, as his knowledge of the planning-process grows.
- A plan for planning, to guide him in his difficult and complex task.

THE OPPORTUNITY

In the technology of system simulation, using a computer, we have a medium that addresses the needs just enumerated. It affords a way to bring the layman into the planning process, introducing him to the skills that he must possess if he is to work effectively with the professional school planner. For the latter, simulation technology offers a way to improve skills, to expand his knowledge of options, and, through the use of computerized techniques that facilitate the analysis of his own activities, to develop new planning tools that could not otherwise be envisioned.

This concept is not advanced as a panacea. The problems that bear on American education can be solved only by people who are dedicated and willing to work. But the opportunity is here to provide them with a starting place and a source of continuing help in devising planning techniques that are adequate for the task. That is the promise of simulation technology, as embodied in the instrument that we call SIMU-SCHOOL.

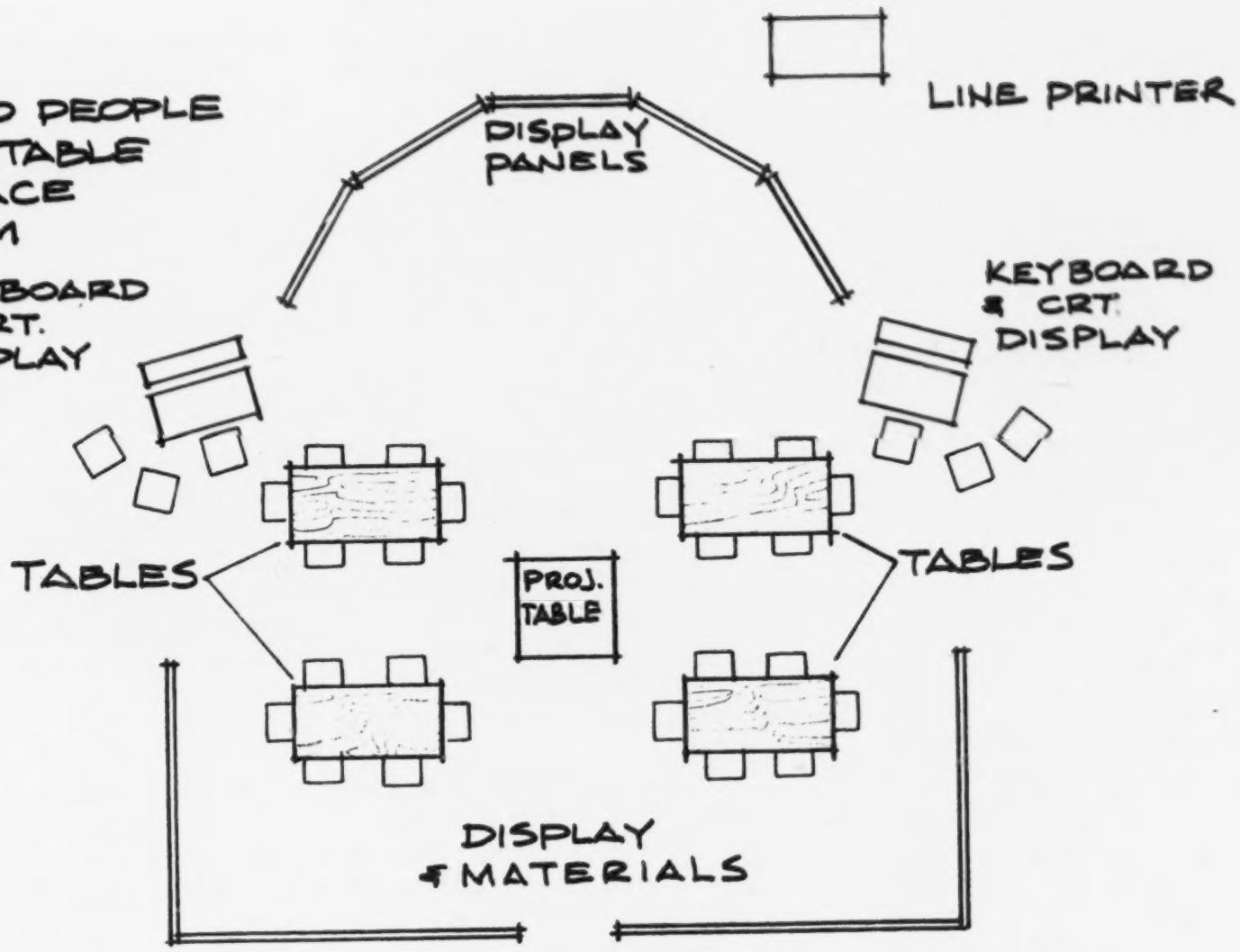
.....ROOM FOR 30 PEOPLE WITH COMFORTABLE WORKING SPACE AROUND THEM



SECTION THREE SIMU-SCHOO

30 PEOPLE
ORTABLE
PACE
EM

EYBOARD
CRT.
SPLAY



SIMU-SCHOOL: AN OVERVIEW

In technical terms, SIMU-SCHOOL is a simulation of the educational-planning process. Plans call for a home unit at a National Center, its site not yet named. Portable field units will be modeled on the home unit. If you have a room that will provide comfortable working space for, say, 30 people, you can bring SIMU-SCHOOL to your community.

THE ELEMENTS

SIMU-SCHOOL employs slides, narration, maps, graphs, discussion, role-playing, and a continuing dialogue with a computer. Participation is the key. One does not look at SIMU-SCHOOL or listen to it. He joins it. For three or four days he becomes an educational planner.

THE ACTION

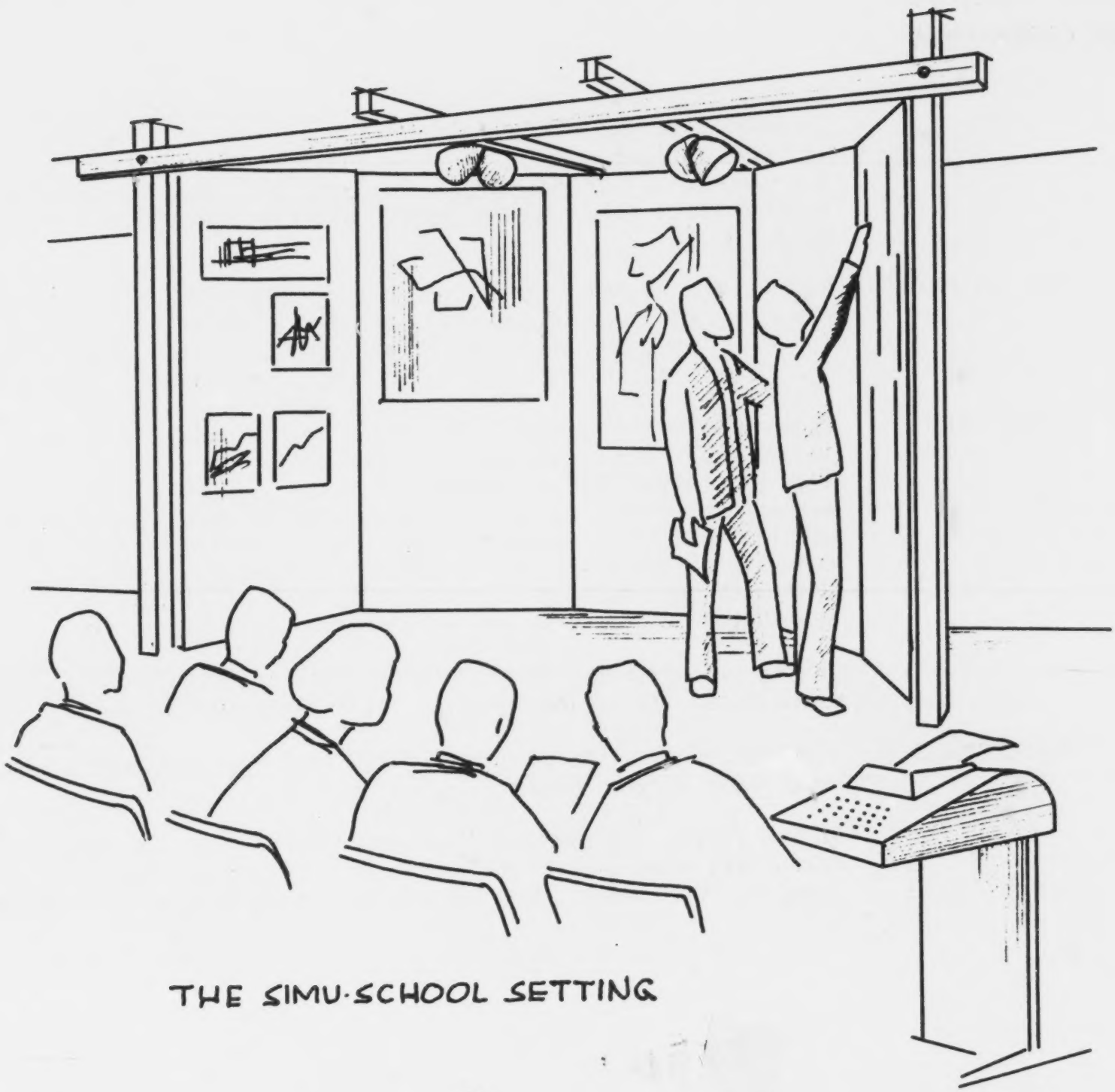
Those who participate in SIMU-SCHOOL learn something about the social issues that bear on education in our time. They translate social issues into objectives for an educational system. They are helped to define the educational resources in a community and to understand the constraints within which the educational system must operate. They learn how other communities are attacking educational problems. Finally, they experiment with ways to sort and sift and assemble all this information in a search for new forms of education suited to their community.

In its own workings, SIMU-SCHOOL employs new and effective education techniques. It is informative. It is exciting and deeply involving.

THE COMPUTER

SIMU-SCHOOL uses the computer in two interactive modes: a simulation mode and a service mode.

In the first, the computer simulates events that the role-players might encounter, were they to make certain decisions as real-life planners. Suppose, for example, they decide to cut costs by curtailing their



THE SIMU·SCHOOL SETTING

building-renovation program. The computer notes this decision, and in due course reports that they now must contend with excessive mainenance costs, angry pupils and teachers in old structures, and the threatened condemnation of certain buildings.

In the service mode, the computer works directly for the planners. They can use it, for example, to look ahead several years at the effect on costs of different student/teacher ratios. In this mode, the computer and its programs can be used apart from the SIMU-SCHOOL setting as a tool for the professional planner. In both modes, the object always is to extend the user, to guide him into different patterns of thought and action, to help him see more clearly the options that lie before him.

THE CONTEXT

In its basic form, SIMU-SCHOOL will put its participants to work as apprentice planners for Everywhere, U.S.A., a fictional mid-western city, population 100,000. (Perhaps a much smaller community will prove more suited to general use.) A body of statistical information describing this city -- its land-use patterns, its income levels, its school populations, and so on -- will be provided for the participants.

Users who wish to substitute information representing their own community and their own educational problems, will be able to do so, possibly to a limited degree in the beginning, but with increasing freedom as SIMU-SCHOOL itself matures and enlarges its potential.

THE PARTICIPANTS

SIMU-SCHOOL is envisioned as a vehicle for bringing persons from all walks of life into educational planning in the community. Many of these people will be without experience in such work. At the same time, SIMU-SCHOOL is a sophisticated data-processing instrument, able

to offer the trained educational
never enjoyed before. This rang
of users will employ SIMU-SCHOOL

THE INEXPERIENCED USER

For the newcomer to educational
service may well be the overview
planning process -- from the def
of plans for implementing soluti

- For this user, SIMU-SCHOOL
  experience. Using a var
  technologies it introduc
  and processes employed b

- SIMU-SCHOOL enables this us
  whole by compressing the
  into three or four days.
  fashion, only one or two
  in depth.

- Users in this category incl
  teachers, administrators
  ning, and persons who ar

USERS OF INTERMEDIATE EXPERIENCE

Persons of greater experience, s
people practiced in school affai
as a problem-solving workshop.

- SIMU-SCHOOL gives them an i
  contact and improved comm

- They can use SIMU-SCHOOL to
  alternatives and of plann
  given kinds of problems.

to offer the trained educational planner services that he has never enjoyed before. This range suggests that different kinds of users will employ SIMU-SCHOOL in different ways.

CED USER

For the newcomer to educational planning, SIMU-SCHOOL's greatest service may well be the overview that it affords of the whole planning process -- from the defining of problems to the sketching of plans for implementing solutions.

- For this user, SIMU-SCHOOL is primarily a teaching/learning experience. Using a variety of media and instructional technologies it introduces him to the basic skills, tools, and processes employed by the educational planner.

- SIMU-SCHOOL enables this user to see the planning process whole by compressing the events of months -- even years -- into three or four days. When SIMU-SCHOOL is used in this fashion, only one or two problems can be pursued, and not in depth.

- Users in this category include parents, public officials, students, teachers, administrators not ordinarily involved in broad planning, and persons who are entering training as planners.

XPERIENCE

Persons of greater experience, such as school board members and community people practiced in school affairs, will be able to employ SIMU-SCHOOL as a problem-solving workshop.

- SIMU-SCHOOL gives them an instrument for increased community contact and improved communication.

- They can use SIMU-SCHOOL to expand their knowledge of educational alternatives and of planning techniques useful in attacking given kinds of problems.

- They can use the SIMU-SCHOOL computer in the service mode, with local data, to explore alternative courses of action and predict the consequences of different decisions.

THE PROFESSIONAL PLANNER

All of the foregoing uses will be available to the professional planner. In addition, he will find that SIMU-SCHOOL contains certain features especially suited to his needs.

- The computer language envisioned for SIMU-SCHOOL (see Appendix III) will permit him to expand existing programs or build new ones shaped to his resources and his problems.

- Local modifications that seem generally useful will be incorporated in the basic SIMU-SCHOOL package. This is an important aspect of the developmental plan envisioned for SIMU-SCHOOL.

- Special recording programs, plus reviews of work required by SIMU-SCHOOL's operating rules, will permit analyses of the planner's activities and speed the evolution of more effective techniques.

- Information about planning technologies and educational alternatives will be pulled together from many scattered sources and made available to the professional planner through SIMU-SCHOOL.

THE TEAM

Important as these separate uses are, they are subordinate to SIMU-SCHOOL's primary value as an instrument for bringing together people of widely divergent interests and experience.

- SIMU-SCHOOL will engage the concerned layman and help bring him to a level of knowledge and experience that permits him to work effectively with the professional planner.

- It will open channels of understa
  do not now exist.

- It will introduce techniques and
  member of the planning team -
  sional -- to make full use of
  sights that he brings to the

GOALS AND EVALUATION

The design envisioned in these pages
consists of a conceptual framework in
learning techniques -- simulation tec
discovery techniques, and so on -- ca
components are familiar. What is new
of techniques that it will offer and
affording opportunities to bend SIMU-
participants or different communities

GOALS

This open nature of the design permit
be made to achieve the goals that are
been stated or implied in the precedi
pating in the project have expressed
SIMU-SCHOOL must realize if it is to
American education. They insist that

- Free the participant, not restri
- Show the ramifications of combin
- Increase problem-solving skill.
- Transform its participants into
  butors to educational plannin

- It will open channels of understanding and communication that do not now exist.
- It will introduce techniques and offer tools that enable each member of the planning team -- private citizen or professional -- to make full use of the unique talents and insights that he brings to the planning process.

LUATION

The design envisioned in these pages (elaborated in the Appendices) consists of a conceptual framework into which a variety of teaching/learning techniques -- simulation techniques, audio-visual techniques, discovery techniques, and so on -- can be inserted. Many of the components are familiar. What is new in SIMU-SCHOOL is the variety of techniques that it will offer and their modularity -- the latter affording opportunities to bend SIMU-SCHOOL to the needs of individual participants or different communities.

GOALS

This open nature of the design permits confidence that SIMU-SCHOOL can be made to achieve the goals that are set for it. Many goals have been stated or implied in the preceding pages. Various persons participating in the project have expressed other outcomes that they believe SIMU-SCHOOL must realize if it is to make an important contribution to American education. They insist that SIMU-SCHOOL --

- Free the participant, not restrict him.
- Show the ramifications of combined decisions.
- Increase problem-solving skill.
- Transform its participants into effective and motivated contributors to educational planning in their community.

- Provide a way to reach out, to expand one's experience, to discover all the options available.
- Effectively compress planning time.
- Educate participants in the planning process.
- Help train future planners.
- Better communicate available information about education and educational planning.
- Permit new knowledge and new techniques to be easily incorporated.
- Help people understand their role in the educational-planning process.

TESTING SYSTEM FLEXIBILITY

Of these objectives, the first, that SIMU-SCHOOL must be a freeing device, not a restricting one, was most often voiced by those who have contributed to the conceptualizing of SIMU-SCHOOL. The pivotal test here is that SIMU-SCHOOL itself grow and change in ways suggested by its users.

- It must permit different groups of participants to move in wholly different directions, using the tools and techniques of SIMU-SCHOOL in wholly different ways.
- It must permit users to follow paths that the designers had not foreseen.
- It must provide means for observers to weigh different patterns and actions that emerge, identify those that seem especially productive, and incorporate them in the SIMU-SCHOOL design for the benefit of the next users.

MEASURING PARTICIPANTS' GROWTH

The growth of planning capabilities is an orc
a logic or rationale of its own. As planning
their progress is marked by milestones -- bas
in how they do their planning and the kind o

- These milestones are established in syst
  unit, using problem situations that a
  in local communities. Field experien
  expand and refine the milestones.

- As participants' decisions are fed to th
  evaluated in terms of the milestones
  rector helps form the computer's resp
  elicit the participants' further grov

- Thus each SIMU-SCHOOL exercise is tailo
  participants and their potentialities
  SIMU-SCHOOL operates, everyone -- pa
  sponsors -- can see, assess, and cri
  development.

AFTER SIMU-SCHOOL

Those who have participated in SIMU-SCHOOL s

- Give evidence, by attending planning me
  educational planning.

- Ask appropriate questions about the edu
  its needs, and its performance.

- Argue for and defend the need for caref
  for following a plan.

- Give evidence of knowing the steps in t
  the techniques available for accompl

GROWTH

The growth of planning capabilities is an orderly process, with a logic or rationale of its own. As planning groups develop, their progress is marked by milestones -- basic qualitative changes in how they do their planning and the kind of decisions they make.

- These milestones are established in system tests at the home unit, using problem situations that are subsequently run in local communities. Field experience in turn serves to expand and refine the milestones.

- As participants' decisions are fed to the computer, they are evaluated in terms of the milestones. A trained unit director helps form the computer's responses in ways that elicit the participants' further growth.

- Thus each SIMU-SCHOOL exercise is tailored to the individual participants and their potentialities for growth. As SIMU-SCHOOL operates, everyone -- participants, observers, sponsors -- can see, assess, and critique the participants' development.

-SCHOOL

Those who have participated in SIMU-SCHOOL should --

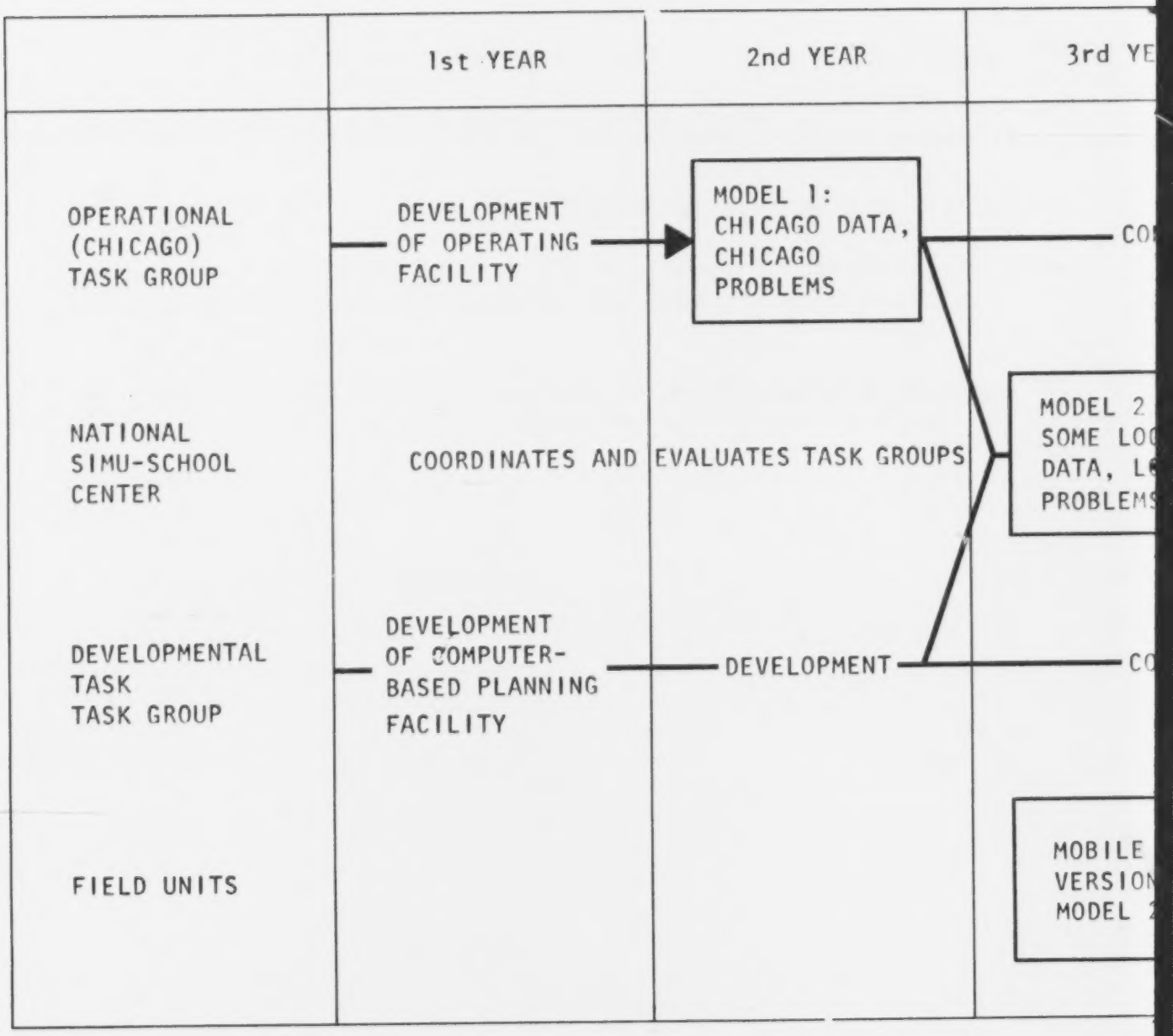
- Give evidence, by attending planning meetings, of interest in educational planning.

- Ask appropriate questions about the educational system, its costs, its needs, and its performance.

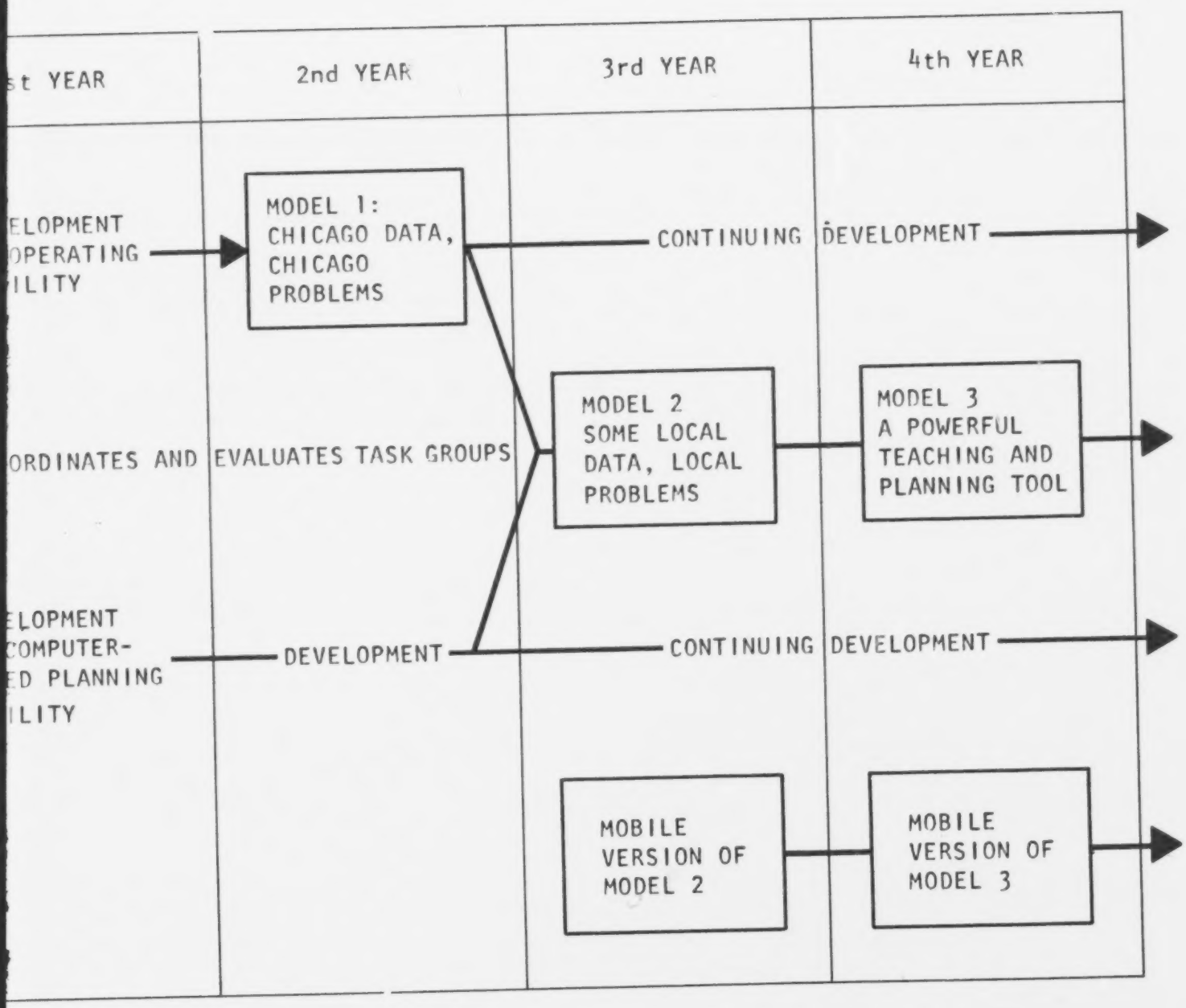
- Argue for and defend the need for careful, thorough planning and for following a plan.

- Give evidence of knowing the steps in the planning process and the techniques available for accomplishing each step.

- Employ techniques and tools introduced by SIMU-SCHOOL.
- Discuss education in terms of options and alternative courses of action.
- Describe clearly defined goals for education in the community.
- Not argue for or support changes or additions to the educational system that are advanced without due regard for adverse effects.
- Caution against unplanned changes that could have adverse effects on operations and costs.



SECTION FOUR DEVELOPMEN


st YEAR
2nd YEAR
3rd YEAR
4th YEAR
ELOPMENT
OPERATING
ILITY
MODEL 1:
CHICAGO DATA,
CHICAGO
PROBLEMS
CONTINUING
DEVELOPMENT
MODEL 2
SOME LOCAL
DATA, LOCAL
PROBLEMS
MODEL 3
A POWERFUL
TEACHING AND
PLANNING TOOL
ORDINATES AND
EVALUATES TASK GROUPS
ELOPMENT
COMPUTER-
ED PLANNING
ILITY
DEVELOPMENT
CONTINUING
DEVELOPMENT
MOBILE
VERSION OF
MODEL 2
MOBILE
VERSION OF
MODEL 3

DEVELOPMENT PLAN

The diagram on the opposite page shows two n
that come together late in the second year o

THE OPERATIONAL TASK GROUP

The upper line, leading to Model I, is plann
ating version at the end of the first year.
SIMU-SCHOOL will be focused on real life and
I will be developed within the Chicago, Illi
will represent an area or community within t
capabilities will not be fully realized in M

COMPUTER-DEVELOPMENT TASK GROUP

The sophisticated computer system proposed f
require a longer development effort (the thi
As of this writing, a site for the work has
ing arrangements (pending) will place the wo
tive jurisdiction of the Santa Clara County

THE NATIONAL SIMU-SCHOOL CENTER

Co-ordinating the work of the Task Groups is
Center. Here again, the site has not been s
Authority for formulating the overall system
Center, working in co-operation with the Tas
two Groups come together late in the second
SIMU-SCHOOL. At that point, the Center assu
operating SIMU-SCHOOL and continuing its dev
rangements permit, the work of the Task Grou
of SIMU-SCHOOL's evolution.

MOBILE FIELD UNITS

Mobile field units will be modeled on the un
and will appear in the third year. The ques
possibility that mobile units based on Model

LAN

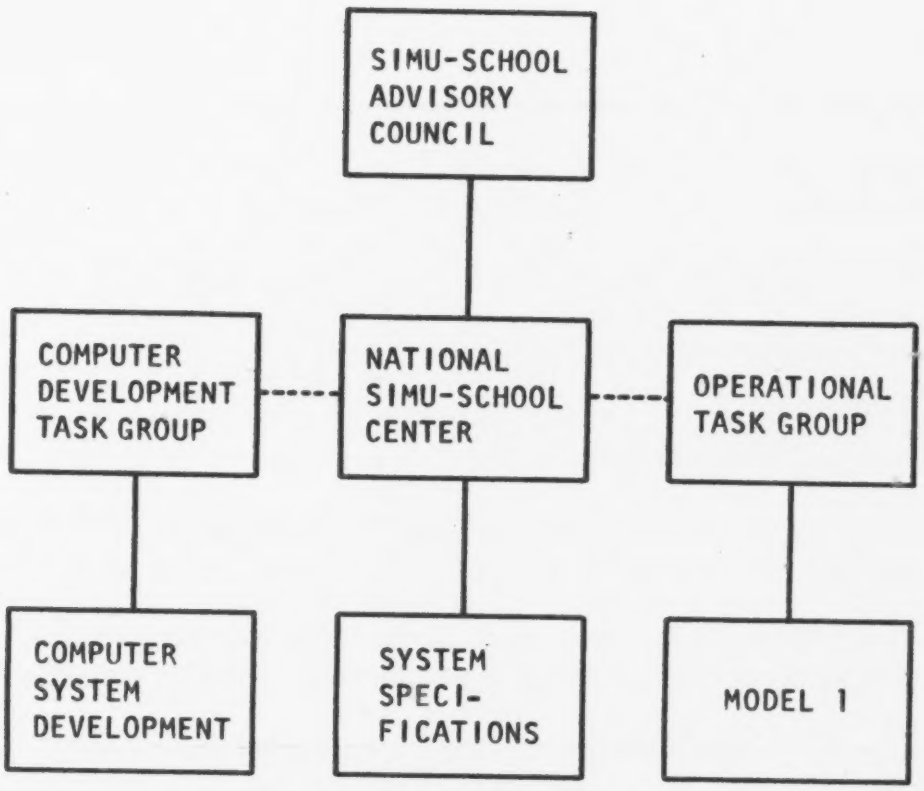
The diagram on the opposite page shows two main lines of activity that come together late in the second year of the project.

ROUP The upper line, leading to Model I, is planned to produce an operating version at the end of the first year. From the beginning, SIMU-SCHOOL will be focused on real life and real problems. Model I will be developed within the Chicago, Illinois, school system. It will represent an area or community within that system. The computer capabilities will not be fully realized in Model I.

ROUP The sophisticated computer system proposed for the later models will require a longer development effort (the third line on the diagram). As of this writing, a site for the work has not been selected. Funding arrangements (pending) will place the work under the administrative jurisdiction of the Santa Clara County (California) public schools.

NTER Co-ordinating the work of the Task Groups is the National SIMU-SCHOOL Center. Here again, the site has not been selected, as of this writing. Authority for formulating the overall system design will rest with the Center, working in co-operation with the Task Groups. Products of the two Groups come together late in the second year to form Model II of SIMU-SCHOOL. At that point, the Center assumes responsibility for operating SIMU-SCHOOL and continuing its development. If funding arrangements permit, the work of the Task Groups may continue, in support of SIMU-SCHOOL's evolution.

NITS Mobile field units will be modeled on the unit at the National Center and will appear in the third year. The question mark suggests the possibility that mobile units based on Model I will appear earlier.



1st AND 2nd YEARS

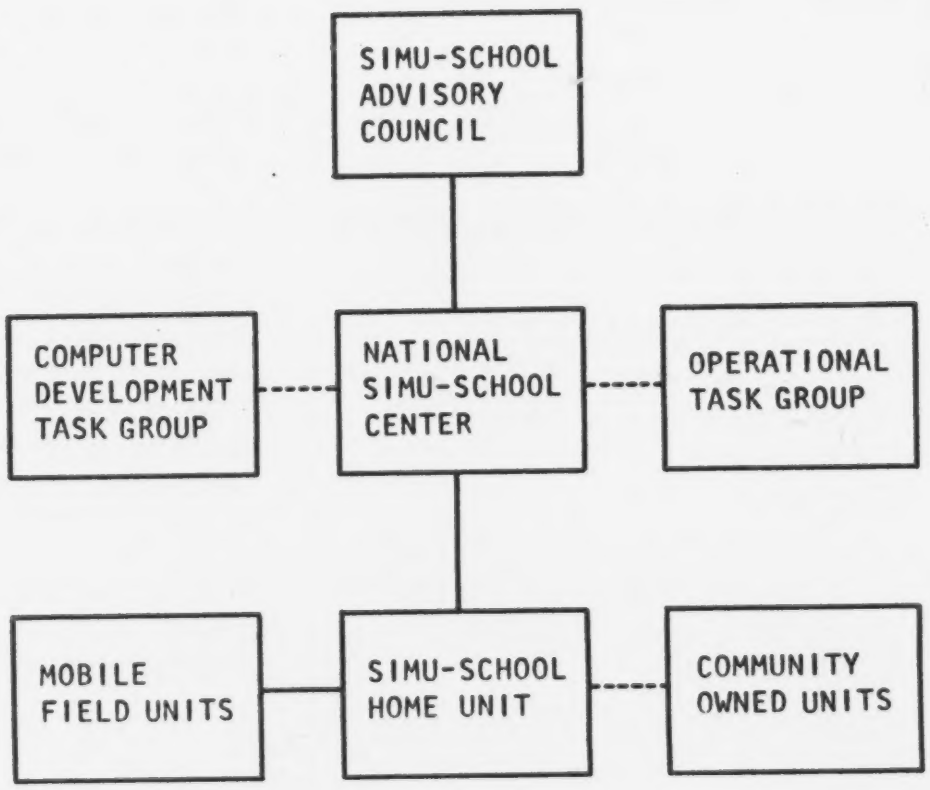
COMPUTER DEVELOPMEN TASK GROUP

MOBILE FIELD UNIT

OPERATIONAL TASK GROUP

MODEL 1

ARS



3rd AND 2nd YEARS

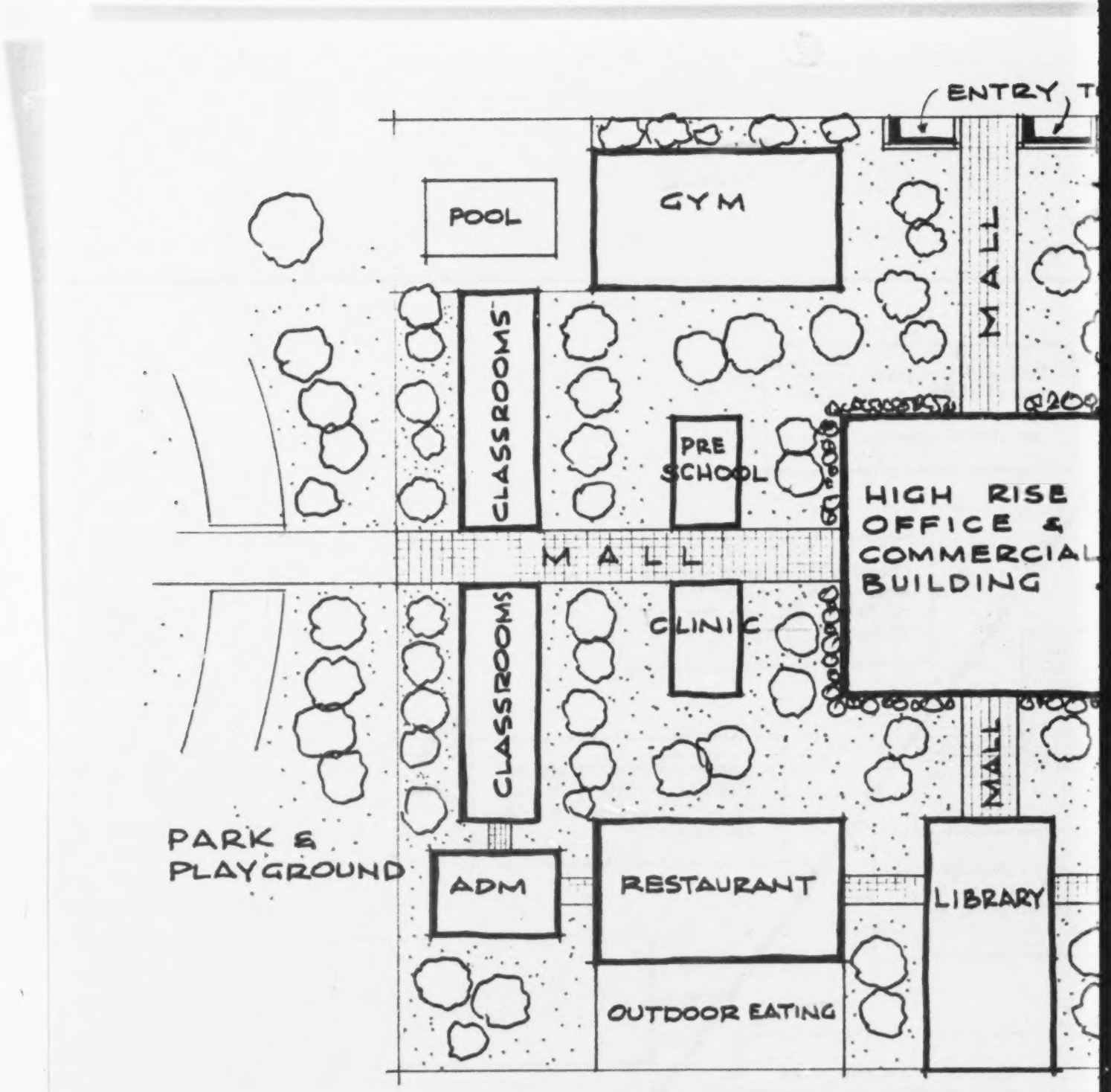
The organizational plan for SIMU-SCHOOL can be expected to evolve as shown on the opposite page.

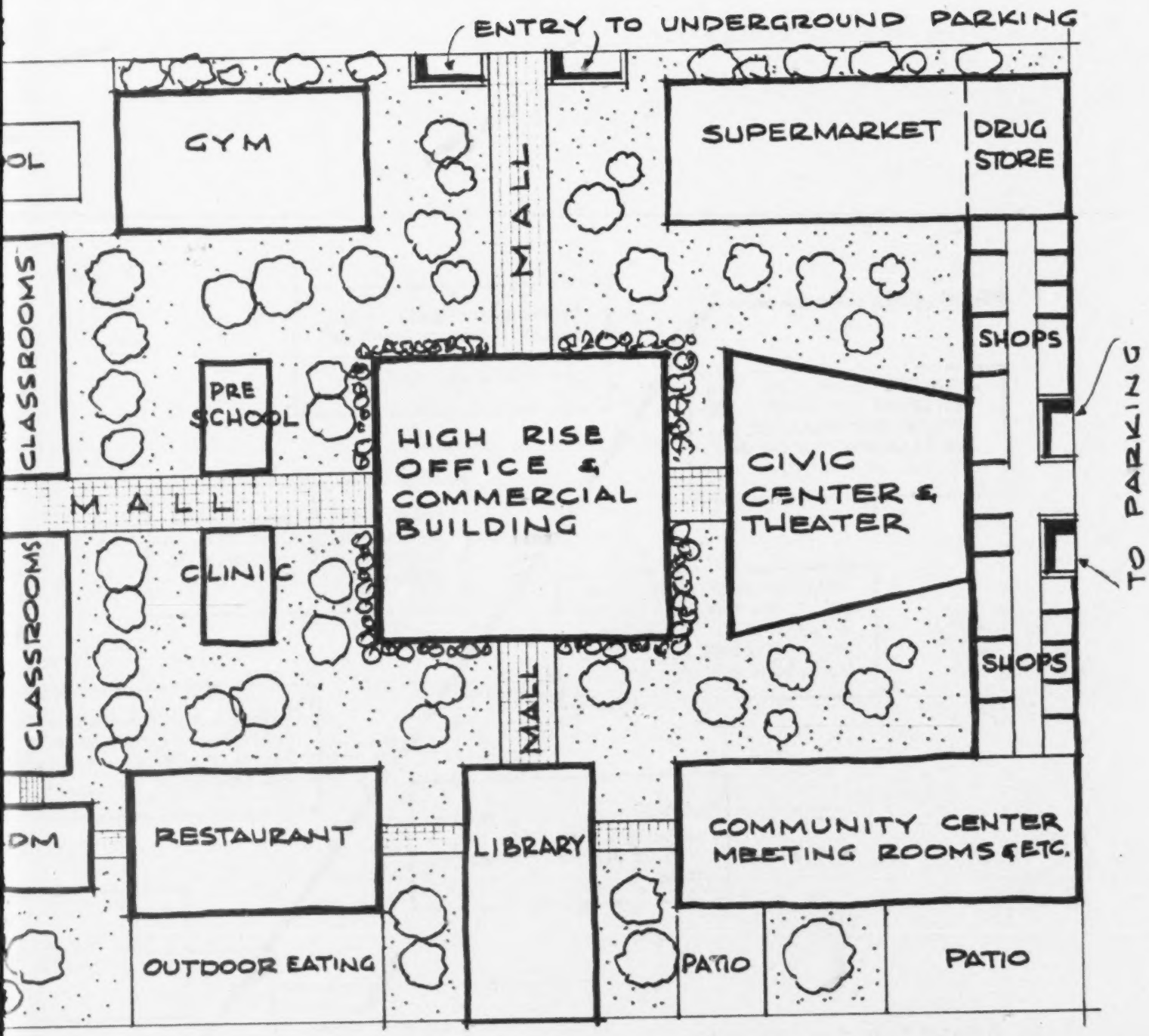
- Note that an advisory council is planned, to insure that SIMU-SCHOOL remains committed to the widest possible service to American education. It must not become parochial in application or of use only to specialists.

- The second chart reflects the very real possibility that some communities will wish to own a SIMU-SCHOOL unit. It can be expected that such a unit will continue to employ computer programs and other materials that are developed at the National Center. Otherwise, the owners would deny themselves SIMU-SCHOOL's main strength -- the accumulation of information, experience, and wisdom from many sources.

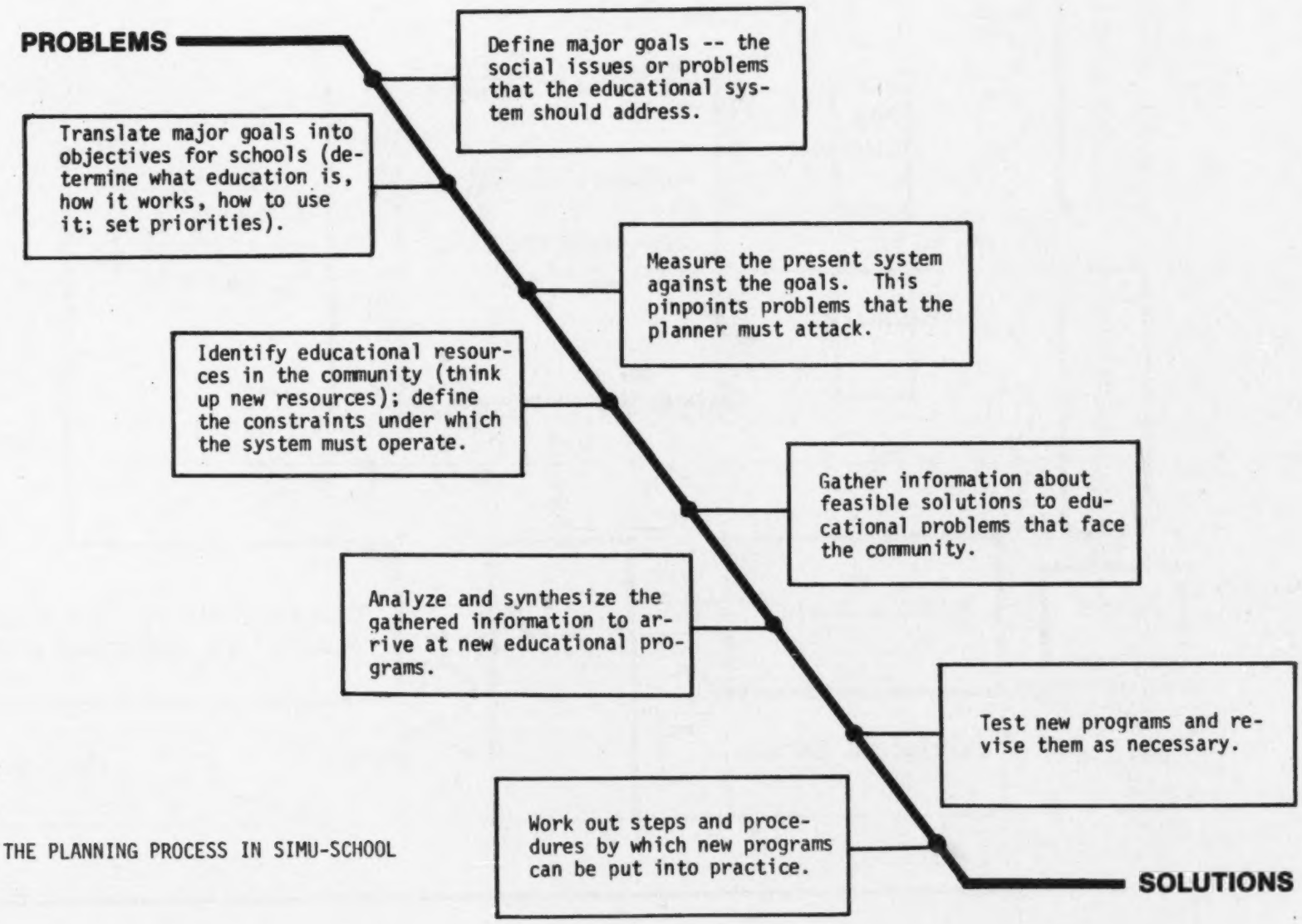
SIMU-SCHOOL

. . . . a tool and process for educational planning


ENTRY
POOL
GYM
MALL
CLASSROOMS
PRE SCHOOL
HIGH RISE OFFICE & COMMERCIAL BUILDING
MALL
CLINIC
CLASSROOMS
MALL
PARK & PLAYGROUND
ADM
RESTAURANT
LIBRARY
OUTDOOR EATING


ENTRY TO UNDERGROUND PARKING
GYM
SUPERMARKET
DRUG STORE
MALL
SHOPS
TO PARKING
PRE SCHOOL
HIGH RISE OFFICE & COMMERCIAL BUILDING
CIVIC CENTER & THEATER
CLINIC
CLASSROOMS
SHOPS
RESTAURANT
LIBRARY
COMMUNITY CENTER MEETING ROOMS & ETC.
OUTDOOR EATING
PATIO
PATIO

APPENDICES


PROBLEMS
Define major goals -- the social issues or problems that the educational system should address.
Translate major goals into objectives for schools (determine what education is, how it works, how to use it; set priorities).
Measure the present system against the goals. This pinpoints problems that the planner must attack.
Identify educational resources in the community (think up new resources); define the constraints under which the system must operate.
Gather information about feasible solutions to educational problems that face the community.
Analyze and synthesize the gathered information to arrive at new educational programs.
Test new programs and revise them as necessary.
Work out steps and procedures by which new programs can be put into practice.
SOLUTIONS

THE PLANNING PROCESS IN SIMU-SCHOOL

APPENDIX I: THE PLANNING PROCESS

The participant in SIMU-SCHOOL will find that the planning process is explained to him as a series of steps or actions. (See the page opposite.) We use the word "steps" with caution. Surely, no planner in life moves in an orderly 1-2-3 progression from one activity to another. The more complex the system, the less likely is the chance of simple action. At the same time, as system complexity increases, so does the planner's need for landmarks. He must recognize that at times he will be steered far off his path by misinformation, by wrong opinions, by things that simply cannot be known, and by change -- what is accepted as true today proves false tomorrow. His actions loop back upon themselves. He must try and try again. He can know where he stands, what he is doing, and what remains to be done, only if he has in mind a map -- a plan for planning.

The process embodied in SIMU-SCHOOL attempts both to provide landmarks (hence the "steps") and reflect the complexity of real-life planning. The participant will move through SIMU-SCHOOL's activities in the order shown. But there are loops and overlaps in that order, as in life. At each step, he will find that new information and new ideas force him to reassess work done earlier.

THE STARTING POINT

Where, in the real world, does it begin, this process

of educati
tect's of
until he
about the
building
any of se
the progra
tice, ign
from mili
too often
problem,
Or it can
many prob
understan
into obje
in total.

COMPRESSI

The educa
amounts o
long perio
SCHOOL is
cess in w
SCHOOL mu
the actio
Or on onl
highly re
lated pla
should va
of differ

PLANNING PROCESS

U-SCHOOL will find that the
plained to him as a series
(See the page opposite.) We
th caution. Surely, no
in an orderly 1-2-3 pro-
vity to another. The more
e less likely is the chance
the same time, as system
so does the planner's need
t recognize that at times
off his path by misinfor-
ons, by things that simply
y change -- what is accepted
alse tomorrow. His actions
ves. He must try and try
ere he stands, what he is
s to be done, only if he
plan for planning.

n SIMU-SCHOOL attempts both
hence the "steps") and reflect
-life planning. The partici-
SIMU-SCHOOL's activities in
there are loops and overlaps
ife. At each step, he will
ion and new ideas force him
earlier.

ld, does it begin, this process

of educational planning? Not in the school architect's office, for the architect cannot start work until he has before him a program -- a statement about the patterns of life and activity that the building will house. The program can arise from any of several sources. If the community wishes, the program can grow from tradition and old practice, ignoring calls for change. Or it can arise from militant pressures, liberal or conservative, too often advocating a single solution to a single problem, to the distress of the system as a whole. Or it can arise from an understanding in depth of many problems that confront the community -- an understanding that has been thoughtfully translated into objectives for the community's schools, taken in total. SIMU-SCHOOL attempts the last.

COMPRESSION

The educational planner in life deals with enormous amounts of information, gathered and processed over long periods of time. Since the object of SIMU-SCHOOL is to introduce the participant to the process in whole, to give him an overview of it, SIMU-SCHOOL must be compressed and simplified. Perhaps the action will focus on a single issue or problem. Or on only part of the educational system. Or on a highly restricted level of detail at which the simulated planning is done. The choice among these should vary to accommodate the interests and needs of different groups of participants.

EMPHASIS

While we speak of the whole planning process, we want to be clear that SIMU-SCHOOL dwells on the earlier steps that lead to the definition of educational programs and places a smaller emphasis on such later activities as the planning and construction of buildings. The needs of the community and of society as a whole can be met only by effective planning at the program level. That is why the emphasis in SIMU-SCHOOL is where it is. The program that emerges from the earlier steps may call for a new building and start the planners to work on it. Or it may go the opposite and turn out to be a work/study program that reduces building needs and creates new problems in transportation and administration. We might note that because of the sponsorship of the American Institute of Architects, many persons assume that SIMU-SCHOOL is directed to the planning of buildings. That is too narrow a view.

A GENERALIZED PROCESS

The school planners who participated in formulating these first, tentative notions of SIMU-SCHOOL quite often describe the planning process in different words or slice the process itself in different ways. Yet it is clear that all have in mind a similar set of actions, performed in similar sequences, for similar reasons. Perhaps SIMU-SCHOOL, over time, will contribute to the evolution of a more consistent vocabulary for educational planning. Or perhaps it will help us see the common process that is represented by the different words. Either would be a gain.

We also want to point out -- and underscore -- that the

process named he
eralized proces
problem-solving
method. It is
design. Here a
comes first to
sists in these

State the p

Gather data

Analyze the

Synthesize

Form an hyp

Test the hy

Generalize

In any applicat
of operations w
stance, goes on
reader will fin
operations and
ning process, f
iterations and
a little examin
of scientific m
the processes o

We dwell on thi

ing process, we want
ls on the earlier
of educational pro-
is on such later
nstruction of build-
and of society as
ive planning at the
mphasis in SIMU-
am that emerges from
new building and start
t may go the opposite
rogram that reduces
oblems in transpor-
ght note that because
n Institute of Archi-
IMU-SCHOOL is directed
at is too narrow a

ted in formulating
SIMU-SCHOOL quite
ss in different words
fferent ways. Yet it
similar set of actions,
for similar reasons.
will contribute to the
ocabulary for educa-
will help us see the
ed by the different

underscore -- that the

process named here is only one application of the generalized process known variously as scientific method, problem-solving method, inductive method, or discovery method. It is also the method of system analysis and design. Here again many definitions exist; one that comes first to mind says that scientific method consists in these operations:

State the problem.

Gather data.

Analyze the data.

Synthesize the data.

Form an hypothesis.

Test the hypothesis.

Generalize or implement the conclusion.

In any application of scientific method, the sequence of operations will change. Data-gathering, for instance, goes on throughout the process. Thus, the reader will find no one-to-one match between these operations and those of SIMU-SCHOOL's education-planning process, for the latter, as we said, has reiterations and loops within loops built into it. But a little examination will reveal that the operations of scientific method are reflected in various ways in the processes of SIMU-SCHOOL.

We dwell on this point, for, as we said earlier in

this prospectus, SIMU-SCHOOL is meant to be a freeing process -- a liberating process. That is precisely the aim of scientific method: To strip away preconceptions, to bring new evidence to bear, to arrive at new conclusions. The process relates to, or is part of, or is congruent with, the process of learning to learn. The participant in SIMU-SCHOOL will not only work at planning for education, he will also find himself involved with a teaching-learning tool that just may be what education is all about.

APPENDIX II: THE SIMULATION PROGRAM

RECRUITING

Properly speaking, SIMU-SCHOOL should begin its workings with the earliest contact between the SIMU-SCHOOL director and the community that SIMU-SCHOOL is to visit. The director should conduct himself from his first conversation in a community with the view that SIMU-SCHOOL has already begun to function in that community. As questions arise, he should explain its aims, its sponsorship, its requirements of participants' time, its history, and anything else about it that may be asked. He should withhold nothing, adapting the length and depth of his answers to the experience and interest of his questioners. His principal aim during his initial contacts is to involve community members intensively in sponsoring the forthcoming SIMU-SCHOOL exercise. Future participants should be enlisted, not just as passive players in a preformatted game, not even just as collaborators who will be exploring future potentialities together for their community, but also, at the same time, as co-workers in making SIMU-SCHOOL function and succeed in their community.

RECRUITING MATERIALS

To these ends, the recruiting materials for SIMU-SCHOOL should set forth clearly the central concern of the SIMU-SCHOOL educators -- to involve community participants in educat

The recruiting materia
citizens that they are
practice with influenc
following up educatior
first, they are to pa
how a school system ca
futures are open to i
can help or damage the
are to learn by direct
educational policy is
in a community negoti
compromises. How a c
its resources of equi
ordinances, informati
tions to make its sch
ditions in the commun

These recruiting mate
before a community de

INTRODUCTORY FILM*

When the SIMU-SCHOOL

*The Introducto
recruiting pro

PROGRAM

d begin its
etween the
ty that SIMU-
ould conduct
in a community
lready begun
uestions arise,
orship, its
its history,
be asked. He
e length and
ce and in-
cipal aim dur-
ve community
e forthcoming
ipants should
yers in a pre-
laborators who
ties together
e same time,
function and

ials for SIMU-
central concern
involve community

participants in educational planning.

The recruiting materials should explain to concerned citizens that they are to be given opportunities to practice with influencing, making, implementing, and following up educational plans and policies. That, first, they are to participate with others in learning how a school system can be changed, what alternative futures are open to it, and how educational planning can help or damage the schools. That, second, they are to learn by direct experience and role playing how educational policy is implemented: How decision-makers in a community negotiate, persuade one another, and make compromises. How a community actually goes about using its resources of equipment, facilities, finances, local ordinances, information flow, manpower, and communications to make its school system cope with changing conditions in the community.

These recruiting materials are to be distributed even before a community decides to go ahead with SIMU-SCHOOL.

INTRODUCTORY FILM*

When the SIMU-SCHOOL participants first come together

*The Introductory Film can also be used for recruiting prospective participants.

for their community exercise, they are to be introduced by the SIMU-SCHOOL director to the problems, challenges and potential rewards of educational planning.

A film or slide sequence could visually present typical problems, such as overcrowded school rooms, functional illiterates applying for jobs, unwanted pregnancies in high schools, undernourished children trying to learn about Mary Manager and Percy Banker being polite to one another, failed bond issues, newcomers in the currently rising prefabricated subdivision, and suburban plenty laced with overstimulated, bored children. A case history of educational plans that failed could perhaps be shown by means of images of initial hopes, poorly digested and poorly co-ordinated planning and policy making. Images might follow of a superb facility that lacks maintenance or good access roads and is set down in an asphalt jungle, of young people shunning the educational environment and drifting back to the street corners, drive-ins, and motor scooters. People could be shown worse off after policies have been implemented than they were before the planning began. Contrasted would be a plan that succeeded, a community in which education works.

Participants could next see with quick images that planning is not so remote that ordinary citizens cannot involve themselves. Planning goes on everywhere all the time: By their poverty, poor people are shaped into sharp budgeters of their few resources, in order to survive and to get a little pleasure out of their blighted lives. Local business and industry hires labor, opens

facilities, advertises, o
of sales or manufacturing
to bring in new local inc
of current tax structures
everyday planning.

Then, with a continuing e
pants would see that educ
to the foregoing kinds of
and ramified. Diverse in
students, the complex dem
variety of alternatives o
business, services in a c
kinds. City, county, sta
involved in the day-to-da
cators have to be respons
mands, the impact of nati
pectations, the unpredict
the need to prepare stude
whose very nature is curr
would see (they need only
what they already deeply
done in shorter time on l
dynamic society continual
obsoleting itself, how th
become compressed in time
on all elements in the co

The introductory film or
with blank frustration.
citizens and school board
their community's educati
examples of efforts that

y are to be intro-
to the problems,
of educational plan-

sually present typi-
school rooms, func-
obs, unwanted preg-
rished children try-
nd Percy Banker be-
bond issues, new-
efabricated sub-
ed with overstimu-
story of educational
e shown by means of
digested and poorly
making. Images might
lacks maintenance or
in an asphalt jungle,
cational environment
corners, drive-ins,
be shown worse off
nted than they were
rasted would be a plan
hich education works.

quick images that plan-
ary citizens cannot in-
on everywhere all the
ple are shaped into
ources, in order to sur-
e out of their blighted
try hires labor, opens

facilities, advertises, orders stocks in anticipation of sales or manufacturing. Chambers of commerce try to bring in new local income or to prevent the erosion of current tax structures. These are all examples of everyday planning.

Then, with a continuing economy of images, the participants would see that educational planning, while similar to the foregoing kinds of planning, is far more complex and ramified. Diverse interests, different kinds of students, the complex demands of modern society, the variety of alternatives open, all are greater: Professions, business, services in a community are of many different kinds. City, county, state, and national officials are involved in the day-to-day conduct of its schools. Educators have to be responsive to rising intellectual demands, the impact of national and worldwide changing expectations, the unpredictable nature of the future and the need to prepare students to cope with contingencies whose very nature is currently still unknown. Participants would see (they need only a very few displays to evoke what they already deeply know) how today we get things done in shorter time on larger scale, how our burgeoning, dynamic society continually strives to prevent itself from obsoleting itself, how the educational planning cycle has become compressed in time and ramified in its influence on all elements in the community.

The introductory film or slide sequence should not end with blank frustration. In brief succession, images of citizens and school boards intervening effectively in their community's educational planning and real-life examples of efforts that succeeded should be shown.

The message of the introductory sequence should be that the choice of an educational future lies in the hands of the community at large. In a deep sense, the community gets back in the future what it is prepared to give today to that future. SIMU-SCHOOL, it should be emphasized, can help a community to find out what it really wants and is ready to pay for, in community education, and can help it achieve its constructive goals.

After a period of questions and answers, during which the director would actively encourage participants to talk about what they have seen and what they feel they can and cannot do about educational policies, they would be plunged into a problem situation.

THE PROBLEM SITUATION

Each SIMU-SCHOOL exercise should embody a single problem situation that can arise in almost any American community, one that actively engages concerned citizens.

The participants, for example, can be asked to think of themselves as concerned citizens of Everywhere, U.S.A. Their city (for example) has 101,234 inhabitants. School children, including children from the county, number 36,703. There are 982 school teachers and administrators, 22 elementary schools, and so on. The participants have been convened because they represent the leadership of Everywhere. Their problem is that yesterday the voters of their city, in a referendum, rejected an increase in property tax levies to meet the day-to-day operating costs of the school system (78% voted no). Moreover, the referendum cannot come up

again for a vote until
already drastic cuts ha
maintenance and school
vocational training, re
counseling, even sports
with laying off teacher
teachers and administra
be asked by the SIMU-SC
roles of the laid-off e

Another example of a pr
den calamity, such as t
within the previous few
dren will be ready to g
there, where will they
which class rooms will
pen thereafter, what lo
be taken, how will the
plans, how will the com
situation may be exacer
nomic, linguistic, medi
constraints.

The participants are in
exercise and to the com
available to them for c
strips or slides, chart
As always, throughout t
for discussion, questio
lem situation. As the
they declare themselves
form coalitions, agree
all part of coming to g
and emotional issues la

e should be
e lies in the
deep sense, the
it is prepared
OOL, it should
find out what
, in community
constructive

s, during which
participants to
t they feel they
licies, they
ion.

y a single prob-
any American com-
erned citizens.

asked to think
Everywhere,
01,234 inhabitants.
om the county,
eachers and ad-
and so on. The
e they represent
problem is that
a referendum,
levies to meet the
ool system (78%
cannot come up

again for a vote until the next local election; and already drastic cuts have been made in construction, maintenance and school programs, including arts, music, vocational training, remedial reading and arithmetic, counseling, even sports. Now the community is faced with laying off teachers or administrators. (Actual teachers and administrators among the participants may be asked by the SIMU-SCHOOL representative to play the roles of the laid-off educators.)

Another example of a problem situation might be a sudden calamity, such as the total loss by fire of PS 17 within the previous few hours. Tomorrow morning children will be ready to go to school. How will they get there, where will they go, who will feed them, into which class rooms will they be squeezed, what will happen thereafter, what longer range measures will have to be taken, how will the city government mesh in with these plans, how will the community pay for the costs? The situation may be exacerbated by racial, cultural, economic, linguistic, medical (drug, VD), legal, or other constraints.

The participants are introduced to the problem of their exercise and to the community resources that they have available to them for coping with it by means of film strips or slides, charts, maps, and verbal briefings. As always, throughout the exercise, time is available for discussion, questions, and answers about the problem situation. As the participants express their views, they declare themselves to one another, take positions, form coalitions, agree and disagree with one another -- all part of coming to grasp the rational, attitudinal, and emotional issues latent in the problem situation.

PARTICIPANTS' ROLES

Next the SIMU-SCHOOL director would introduce the participants to the roles that will have to be filled, and he would ask for volunteers. Based on his previous conversations in the community, he might or might not recommend that roles be taken by people who occupy them in real life -- the roles may include city officials; school personnel, such as third-grade teachers, principal of PS 42, physical education instructor; professional people such as lawyer, architect, doctor, local judge, librarian; local businessmen and contractors; clergy; housewives, with school children; actual school children themselves; members of patriotic societies; members of the community school and zoning boards. Each participant, by taking his role, represents community resources and community demands, and each can give or withhold assent and try to recruit the others to build a shared community future for the common school system.

As each participant would take his role, he would turn to the computer for instructions and receive back a short statement of the resources that he commands and the kinds of decisions that he will be called upon to make. As he will participate in the exercise, he will learn ever more deeply the significance of the resources and constraints that bind him and all the other participants into their shared problem situation. Subject only to the good opinion of his colleagues and of the SIMU-SCHOOL representative, he is free to express his own opinions and convictions and to implement them if he can convince the other participants with whom he interacts.

ACTIONS TAKEN BY PARTIC

When the problem begins
give the participants a
would have to take duri
options available to th
children be told to do
ing PS 23, go to variou
is their teacher?

How will they get to wh
PS 17 staff do? What a
lice and firemen? When
next few days and weeks

In carrying out the pol
his role has the capabi
the resources within hi
thorizes the transfer o
in rules governing his
on the liability and re
juries to school childr
whether PS 17 will be r
vide parking for custom

At any time during an e
may have responsibiliti
parts they play. The p
a decision somewhere in
teers to pick up his sc
them to the other schoo
The city attorney and t
him because of city lia
inability to pay insura

would introduce the par-
ll have to be filled,
s. Based on his previous
, he might or might not
by people who occupy
may include city of-
h as third-grade teachers,
ducation instructor; pro-
r, architect, doctor,
businessmen and contrac-
school children; actual
mbers of patriotic so-
ity school and zoning
taking his role, repre-
community demands, and
nt and try to recruit
ommunity future for the

e his role, he would turn
ns and receive back a
es that he commands and
e will be called upon to
in the exercise, he will
gnificance of the re-
ind him and all the other
d problem situation. Sub-
of his colleagues and of
e, he is free to express
ns and to implement them
participants with whom he

ACTIONS TAKEN BY PARTICIPANTS

When the problem begins the SIMU-SCHOOL director would give the participants an agenda of decisions that they would have to take during the next hour or more and the options available to them: What will the PS 17 school children be told to do -- stay home, all go to neighboring PS 23, go to various other schools according to who is their teacher?

How will they get to where they have to go? What will PS 17 staff do? What about co-ordination with the police and firemen? When will decisions be made for the next few days and weeks? What about longer-range plans?

In carrying out the policy decisions, each participant in his role has the capability of yielding or withholding the resources within his power. The city treasurer authorizes the transfer of funds to the school system, within rules governing his behavior. The city attorney passes on the liability and responsibility of the city for injuries to school children. The school board decides whether PS 17 will be rebuilt or its site cleared to provide parking for customers of the local merchants.

At any time during an exercise, some of the participants may have responsibilities to take action, because of the parts they play. The principal of PS 17 may have to get a decision somewhere in the school system to use volunteers to pick up his school's children and to transport them to the other schools decided on by the superintendent. The city attorney and the treasurer may have to overrule him because of city liabilities for possible accidents and inability to pay insurance premiums to cover such costs.

COMPUTER'S SIMULATION ROLES

After all the participants take their roles and receive their role descriptions, the exercise would begin over the computer.

Key data files characterizing the educational system and the community would have been preset into the program system by the SIMU-SCHOOL educators at the home office. Examples of such data are:

- Facilities, by kinds of schools, supply and maintenance depots, physical education buildings, cafeterias, etc.
- Student population, by age, family background, educational attainments, test scores, special interests, etc.
- Administrators, by age, experience, interests, training, etc.
- Teachers, similarly characterized.
- Existing allocations of students, administrators, teachers, etc. to facilities.
- Support personnel, by characteristics and services.
- Instructional costs, by salaries, overhead, fringe benefits, administrative costs.
- Land costs and constraints, including acquisition, current expenses, upkeep costs.
- Building f
  income.
- Land utili
- Social, ec
- Population

Also in the com
rules tell the
when the partic

The rules that
the school syst
that maintain o
facilities. Th
undertakings an
not easily be r
of functioning.
decisions and n
but it would ho
sequences. In
by their planni
computer, could
school system.

Conversations W

As the particip
cisions are ent
talk to the com
gram can inter
and asks for fu
life, the plann

roles and re-
rcise would be-

ational system
et into the
ators at the
e:

supply
al edu-
tc.

y back-
, test

ce, in-

d.

, adminis-
ilities.

stics and

, overhead,
e costs.

uding ac-
pkeep costs.

- Building funds, by availability, interest income.
- Land utilization parameters.
- Social, economic, cultural, racial parameters.
- Population change projections.

Also in the computer would be operating rules. These rules tell the computer what to do to the above data, when the participants take action.

The rules that implement innovative policy changes for the school system would be quite different from those that maintain or terminate educational services and facilities. Therefore, if the participants initiate new undertakings and then pull back, the school system could not easily be restored to its previous condition and ways of functioning. The computer would simply implement the decisions and not resist, even should they act foolishly; but it would hold them responsible as a group for the con sequences. In other words, the participants as a group, by their planning and policy-making actions taken over th computer, could drastically affect the operations of the school system.

Conversations With Participants

As the participants make their planning decisions, the de cisions are entered into the computer. The participants talk to the computer in natural English. The computer pr gram can interpret most things said in natural language and asks for further instructions if it cannot. As in life, the planners and educational decision-makers expres

themselves in high-level language. Many of the decisions they make are ambiguous, and the consequences of their decisions are unclear to the computer. The computer does not reject any decision, however drastic its implications or unclear its intent. If instructions to it are unambiguous, the computer says back to participants what actions it is about to take. Sometimes it explicates alternatives that are open to participants for further decisions. In many cases these responses of the computer, although in natural English, are phrased differently from the way the participants talked when they first intervened with it. As a result, conversations spring up between the participants and the computer, during which the computer tries to wrest clear instructions from the decision-makers. These conversations are an important part of the learning experiences of the participants.

Another important element in the process of educating the participants in educational planning consists in the following requirements (monitored by the computer) for authorizations of decisions taken. One participant alone can take at most only a very few significant actions; most actions require the concurrence of other participants. The computer does not help a participant to get his concurrences; this he must do face-to-face with other participants or by written messages. By this means a web of inter-involvements is woven. The inter-involvements change constantly as the exercise proceeds and are dependent on the decisions taken by the individual participants. But only legitimate, authorized decisions are implemented by the computer. For example, if the city controller has to approve disbursements of more than $200.00, no participant can make the computer spend such

sums without his conc

As back-and-forth tal
among the participant
SIMU-SCHOOL represent
matters that have to
proceed. At his disc
who have made unclear
cate their consequenc
of time makes it wort
of decision-making an
the unclear or unreco
tion.

Interpretation and Im

When, in the judgment
guity has been clarif
reasonable interpreta
declares the current
necessary, he interpr
ticipants. The compu
ment decisions that a
er; in other words, g
sions are up to the p
not solve their plann

The computer then wor
sions, prepares repor
and revises all the d
the educational syste
days, weeks, or longe
sion agenda is prepar
pants face the conseq

any of the de-
the consequences
computer. The
, however drastic
t. If instruc-
uter says back
out to take. Some-
are open to par-
many cases these
n natural English,
the participants
h it. As a result,
articipants and the
ries to wrest clear
. These conversa-
earning experiences

cess of educating
ning consists in the
the computer) for
One participant alone
nificant actions;
of other partici-
participant to get
ce-to-face with
sages. By this
woven. The inter-
e exercise proceeds
aken by the individual
authorized decisions
r example, if the
rsements of more than
computer spend such

sums without his concurrence.

As back-and-forth talk proceeds with the computer and among the participants, the computer delivers to the SIMU-SCHOOL representative current lists of all ambiguous matters that have to be resolved before the exercise can proceed. At his discretion he intervenes with the people who have made unclear decisions to clarify them or indicate their consequences. If, in his judgment, the elapse of time makes it worthwhile to cut short the current round of decision-making and co-ordination, he calls together the unclear or unreconciled parties and secures clarification.

Interpretation and Implementation of Decisions

When, in the judgment of the SIMU-SCHOOL director, ambiguity has been clarified enough for the computer to make reasonable interpretations and implement decisions, he declares the current epoch of the exercise over. If necessary, he interprets unclear decisions for the participants. The computer in turn is programmed to implement decisions that are not very coherent with one another; in other words, good sense and integration of decisions are up to the participants, and the computer will not solve their planning problems for them.

The computer then works out the consequences of the decisions, prepares reports on the results of actions taken, and revises all the data describing the current state of the educational system. Time is moved forward by hours, days, weeks, or longer, and the exercise proceeds: A decision agenda is prepared; options are offered; the participants face the consequences of their planning decisions.

COMPUTER'S SERVICE ROLES

The Computer Used For Contingency Planning

Before a participant reaches the stage of making a decision, the computer would be available to answer questions of the form, what will happen if we do such and such? Suppose that we try to accommodate 130 fourth, fifth, sixth graders from PS 17 in PS 43, will there be seats for them? Where else is room available? Or suppose that we plan to rebuild PS 17 on a new site, what sites are available? What are demographic data in the neighborhoods? Bus routes? Traffic patterns?

In general, the computer is to be constantly available to answer questions on a contingency basis -- what resources are available? What specific steps will be taken if such and such a decision is implemented? For all this conversation about contingencies, the computer is programmed to give answers even though the questions are very loosely put; and it accompanies its answers with the assumptions that it makes to answer them. If, for example, it is asked what room is available in a given school for more students, it might answer with the assumption that the questioner means classroom space. It might at the same time indicate that there are other kinds of space available or that there are possibilities of changes in the allocations of space that might make more room available. It would also constantly be on call to answer questions concerning who in what roles has to concur before a given planning decision is implemented. All this

information would
out form, so that
formation to anot
differences, and
SCHOOL educationa
computer carries
sign its response
planning -- for s
for letting him k
take to become mo
different authori
to plan effective

The Computer Used
For The Future

Among the first r
SCHOOL during the
built for the fir
of the simulation
know about educat
He would be or ma
state of the art
possible, he will
or their formulat
usefulness to pla
for use by laymen
in ordinary langu
level generalizat
planning programs
made available to
cises. This will
Model I computer

lanning

age of making a
ilable to answer
pen if we do
to accommodate
om PS 17 in PS
Where else is
plan to rebuild
available? What
rhoods? Bus

onstantly avail-
ngency basis --
specific steps
cision is imple-
about contingencies,
answers even though
and it accompanies
at it makes to an-
asked what room is
e students, it might
questioner means
ame time indicate
available or that
in the allocations
available. It
answer questions
concur before a
ted. All this

information would be available in rapidly printed-out form, so that one participant can bring his information to another for persuasion, negotiation of differences, and assent. In every instance, the SIMU-SCHOOL educational resource people who specify how the computer carries out its contingency planning would design its responses primarily as a tool for teaching planning -- for sharpening a participant's questions, for letting him know of courses of action that he can take to become more effective, for understanding how different authorities and resources have to be pooled to plan effectively.

The Computer Used to Explore and Evaluate Alternatives For The Future

Among the first resource people to be recruited for SIMU-SCHOOL during the first year, when Model I is still being built for the first time, one educator would become part of the simulation team, whose function it would be to know about educational planning programs in use elsewhere. He would be or make himself an authority on the current state of the art of using the computer for planning. If possible, he will obtain either the programs themselves or their formulation and keep current on their potential usefulness to planners. These programs will be adapted for use by laymen -- people who will use them by speaking in ordinary language, using ambiguous concepts and high-level generalizations. As this adaptation work proceeds, planning programs will be incorporated into Model I, and made available to the participants in the community exercises. This will be part of the evolutionary growth of Model I computer programs. At the same time, the programs

will be designed and written in more professional form for the Model II (community data) simulation. The step-by-step evolution of planning capabilities is an integral part of the planning for ultimate use in Model III (for professional educational planners); in this way, from the start of the SIMU-SCHOOL project, work will be underway toward the Model II and Model III programs.

As far as concerns the participants in the community exercises, the existence of planning programs in layman-usable form will serve to make possible the highest form of educational planning, the form in which planners not merely select from existing, known alternatives, but also actively use cost/benefit analyses to create new alternatives not previously envisaged. They will be able to do this, because the planning programs will automatically range over the data constantly being updated in the computer as the exercise proceeds. Model II planners will be able to do this kind of advanced educational planning, taking advantage of the local data which will exist in the Model II program system.

FINAL DEBRIEFING

Time should ordinarily be allowed in the exercise schedule for the participants to review the decisions they have taken and the consequences to which they lead. As decided by the SIMU-SCHOOL director, debriefings should be called in which all participants meet together and review the decisions they have taken, the consequences to which they have led, and the current condition of educational activities in the model community. Debriefings called during the course of the exercise (one or more,

as indicated by the par
able the participants t
educational system that
to take corrective acti
close of the exercise w
lessons learned during

professional form
mulation. The
apabilities is an
timate use in Model
anners); in this
OL project, work
and Model III pro-

in the community
programs in layman-
ble the highest form
which planners not
lternatives, but al-
s to create new al-
They will be able
grams will automat-
y being updated in
s. Model II plan-
advanced education-
local data which
ystem.

the exercise sched-
he decisions they
hich they lead. As
debriefings should
meet together and
, the consequences
ent condition of edu-
mmunity. Debriefings
ercise (one or more,

as indicated by the participants' progress) would enable the participants to sense developments in the educational system that they would like to alter and to take corrective action. The debriefing at the close of the exercise would help bring to awareness lessons learned during the exercise.

APPENDIX III: THE SIMULATION TECHNOLOGY

ADVANTAGES OF RELATIONAL DATA SYSTEMS

The key to producing the Simulation Program described in the previous section is to use a special kind of computer program system known as a Relational Data System. Relational data systems incorporate the capabilities of data management systems and of information storage and retrieval systems, but they have an additional capability of crucial importance for using computers as tools for planning: Not only are they able to retrieve specific facts explicitly stored in a data base, but also they have the ability to deduce facts that are implicit in the stored data. They respond to queries that require the application of rules of inference to information in the data base. In addition, some relational data systems can accept queries and reply to questions in language that seems nearly natural, something close to ordinary English. In short, relational data systems do the following:

- Accept base data, instructions, and questions in nearly natural language.
- Build, manipulate, and transform a complex data base.
- Draw connections among kinds of data in the data base.
- Derive inferences that are implicit in the data that it contains.
- Build their ow
  bootstrap op
  gramming, pr
  expressed in
  its capabili
  great hierar
- Supply users w
  etc., in near

Compared to convent
the emphasis in rel
efficiency to flexi
the rule rather tha
only partially desc
to be a small, intu
the entity, and man
to be specified bef
scribed. In other
base, the search pr
planner than it is
reservation or main
warehouse. The lat
for its speed on th
about an entity in
data systems are mo
all possible fragme
or not they are def
set. Hence, the ne
the interrelationsh
out preplanning. D

ogram described
ecial kind of
ational Data Sys-
ate the capa-
d of information
y have an addi-
e for using com-
are they able
stored in a data
o deduce facts
They respond
n of rules of
ase. In addi-
accept queries
t seems nearly
nglish. In
following:

nd questions

a complex

ata in the

it in the

- Build their own higher-level capabilities by bootstrap operations -- without further programming, provide a rich set of instructions expressed in natural language, that increase its capabilities as it is used. Do this in great hierarchical depth.

- Supply users with information, tables, graphs, etc., in nearly natural language.

Compared to conventional data systems (file systems), the emphasis in relational data systems moves from efficiency to flexibility. Fragmentary information is the rule rather than the exception. Many entities are only partially described. A relational statement tends to be a small, intuitively cohesive unit for describing the entity, and many relational statements often have to be specified before the intended entity is fully described. In other words, when a user explores the data base, the search process is more like the probing of a planner than it is like entering a hotel or airplane reservation or maintaining the status of inventory in a warehouse. The latter kind of search depends heavily for its speed on the physical contiguity of information about an entity in the data base, whereas relational data systems are more concerned to capture and represent all possible fragments that may become important, whether or not they are defined in the program system at the outset. Hence, the network of relations about an entity and the interrelationships among different entities grow without preplanning. Defining new relationships or attribute

is a routine rather than traumatic event.

Relational data systems are capable of using relations among data and relations among relations, to almost any level of complexity. These relations, furthermore, have logical properties in their own right, independent of the entities or instances that they tie together. By virtue of these properties, relational data systems can work with the higher-level intentions of their users, even if expressed in loose or vague language, and set up such intentions as general axioms to guide their question-answering and inference-deducing operations. In effect, each request that a user makes of the system becomes a self-contained problem. The user prescribes what he wants, the data system takes his prescriptions as a set of primitive postulates, and fashions its operations as a logical sub-system capable of carrying out the user's intents. The data system keeps reading meaning into the user's demands; it keeps on deducing theorems concerning what it has to do, and then it conducts itself in that image.

Furthermore, a relational data system can test a given input to determine whether or not it confirms or denies existing data. Such inference-capabilities can be invoked in responding to queries, so that information pertinent to the query can be derived by the data system.

What these capabilities mean is that relational data systems can do for SIMU-SCHOOL what no conventional data system is capable of doing: infer facts that have not been explicitly entered into its data base.

(The foregoing observati
systems are adapted from
commissioned by the Rome
Force System Command, Gr
entitled Relational Data
performed by the Auerbac
the Auerbach Report.)

HOW SIMU-SCHOOL WILL USE

The Simulation Program o
of this proposal is form
the SIMU-SCHOOL educator
a relational data system

- Once the relational
  ational (eighth mo
  program works (ten
  team will do almos
  ing and implementi
  English. In turn,
  will perform all t
  accept natural-lan
  draw connections,
  build higher-level
  operations, execut
  of users, output i
  al mathematical la

- The relational data
  many questions phr
  -- ?" Examples:
  another school?
  the new Roslyn Pa

ent.

f using rela-
relations, to
e relations,
in their own
instances that
e properties,
the higher-
if expressed
p such inten-
r question-
ations. In
s of the sys-
The user pre-
m takes his pre-
ulates, and
sub-system cap-
ts. The data
user's demands;
ing what it has
that image.

n can test a given
confirms or denies
lities can be in-
at information
by the data sys-

relational data
no conventional
er facts that have
data base.

(The foregoing observations concerning relational data systems are adapted from a survey, dated September, 1970, commissioned by the Rome Air Development Center, Air Force System Command, Griffiss Air Force Base, New York, entitled Relational Data System Study (RADC TR 70 180) performed by the Auerbach Corporation, hereafter called the Auerbach Report.)

HOW SIMU-SCHOOL WILL USE A RELATIONAL DATA SYSTEM

The Simulation Program described in the previous section of this proposal is formulated with the assumption that the SIMU-SCHOOL educators will use the capabilities of a relational data system in the following ways:

- Once the relational data system is made operational (eighth month), and the simulation program works (tenth month), the simulation team will do almost all its work on designing and implementing SIMU-SCHOOL in ordinary English. In turn, the relational data system will perform all the functions listed above: accept natural-language input, build data base, draw connections, derive implicit implications, build higher-level capabilities by bootstrap operations, execute loosely expressed intents of users, output in near-natural or conventional mathematical language as appropriate.

- The relational data system will be able to answer many questions phrased as "What will happen if -- ?" Examples: If teachers are moved to another school? If a new facility is built for the new Roslyn Park subdivision? Which city

departments and officials would have to be involved and give approval?

- The simulation system will grow in evolutionary manner as actual exercises succeed one another in local communities. Each exercise will result in queries formulated, probes and plans expressed, new concepts defined in the relational data system.

- All these probes, concepts, plans will come to exist in the central computer at the SIMU-SCHOOL home office. There the simulation team will review them as one of its continuing activities, thereby building a planning culture into the relational data system. This build-up will be very much like what happens in a professional planning office after it has worked successfully as a team on a succession of projects: By working together a planning team builds its own vocabulary, key terms to express complex concepts, and its working rules and in-house conventions and agreements. With a relational data system, it becomes possible for a simulation team to work in the same way with the experience of successive generations of users, all working on the same circle of problems, each generation building on the culture derived from its predecessors.

- Some relational data systems have the

officials would have to be
e approval?

tem will grow in evolu-
s actual exercises succeed
ocal communities. Each
sult in queries formu-
d plans expressed, new
in the relational data

concepts, plans will come
central computer at the
office. There the simu-
review them as one of
ctivities, thereby build-
culture into the relation-
This build-up will be
what happens in a pro-
ing office after it has
lly as a team on a suc-
cts: By working together
builds its own vocabu-
to express complex con-
working rules and in-
ns and agreements. With
ta system, it becomes
simulation team to work
with the experience of
rations of users, all work-
circle of problems, each
ding on the culture de-
predecessors.

ata systems have the

- capability of accepting subordinate programs written in such languages as FORTRAN IV, COBOL, and BASIC, as well as computer assembly code. This capability makes the data system almost indefinitely expansible, by incorporating computer programs executed elsewhere and adapted to the relational data system.

- This feature enables the professional staff member responsible for knowing about and obtaining educational planning programs created by other agencies to adapt them one by one, as they come into existence and prove themselves in actual use in the educational-planning community at large.

- After programs produced elsewhere are adapted or rewritten for use in the SIMU-SCHOOL data system, it will be possible to use the ordinary-language and bootstrap capabilities of the data system to tailor the exotic programs, without further computer programming, both to the needs of laymen and to the more sophisticated needs of professional planners.

- In adapting Model I (self-contained simulation) to the properties and data of local communities (resulting in Model II), most of the adaptation will require no further programming. The capabilities of the relational data system to redefine its own data structures and operating rules will be exploited in evolving Model II from Model I.

EVALUATION OF THE CALTECH RELATIONAL DATA SYSTEM (REL) BY THE AUERBACH CORPORATION

The study of relational data systems commissioned by the Rome Air Development Center (Auerbach Report) surveys the following relational data systems, which it takes to be the principal current systems:

QA 3.5	Question-Answering System	Stanford Research Institute
CONVERSE	.....	System Development Corporation
ASP	Associative Stored Processor	Hughes Aircraft Corporation
REL	Rapidly Extensible Language	California Institute of Technology
RDF	Relational Data File	Rand Corporation
RSS	Relational Data Structure	Computer Corporation of America
TLC	Teachable Language Comprehender	Bolt, Beranek, and Newman, Inc.
...	Question-Answering Machine	Harvard University

Among these eight systems, the Caltech relational data system, REL, can be adapted as well to the needs of SIMU-SCHOOL as any of the others, and it has certain features which especially recommend it as a planning and simulation tool. Concerning the Caltech relational data system REL, the Auerbach report reaches the

following conclusion

➤ REL consists of
ting system, a
age data-base

➤ The operating sy
uling system r
requesting the
line, and thre
simultaneously
lation study,
used.

➤ A single languag
languages with
can parse sent
lar, context-f
eral-rewrite.
contains one c
vailable with
associated wi
language is us
available with
English terme
SCHOOL simula
to use by layn

➤ . . . The progra
used on an ex
been applied
tics, to a bo
as to a varie

commissioned by
bach Report)
systems, which
systems:

rd Research
itute

Development
oration

Aircraft
oration

rnia Institute
echnology

orporation

er Corporation
America

Beranek, and
nan, Inc.

rd University

h relational data
to the needs of
it has certain
it as a planning
Caltech relation-
ort reaches the

following conclusions:

- REL consists of three major facets: an operating system, a language processor, and language data-base packages.

- The operating system has the function of scheduling system resources to the various users requesting them. Forty terminals are on-line, and three users may share core memory simultaneously. Based on an extensive simulation study, a time slice of 5 seconds is used.

- A single language processor handles all formal languages within REL. The language processor can parse sentences in grammars that are regular, context-free, context-sensitive, or general-rewrite. A language/data-base package contains one of the alternative languages available within REL and the data structures associated with the data base for which the language is used. At present, the only language available with the system is a small subset of English termed REL English. (Part of the SIMU-SCHOOL simulation task is to adapt this idiom to use by laymen in SIMU-SCHOOL exercises.)

- . . . The programs have been tested and are being used on an experimental basis. REL English has been applied to a set of United Nations statistics, to a body of anthropological data, as well as to a variety of test data bases.

Several aspects of REL are significant:

- First, it recognizes the importance of integrating a language process closely with an operating system. None of these other systems reviewed have considered the environment in which the question-answering system will operate.

- Second, the manner of combining syntactic and semantic analysis is important. It takes advantage of entries in the data base to disambiguate data. (This feature provides a powerful teaching tool for educational planning by laymen in SIMU-SCHOOL.)

- Third, the single language processor is an advantage in that many individuals can use the system and develop their own way of addressing their files. The evaluation here notes a difficulty for use of REL by intelligence analysts that does not apply to Model I and II SIMU-SCHOOL applications.

- Fourth, sentences that specify temporal relations are handled by the system. (Temporal relations are especially important for planning applications; the importance of a planning activity tends to be proportional to the time span over which it is projected.)

Currently t
proposing t
planning la
Laboratory
Quality Lab
will co-ope
Propulsion

The most ex
a data base
the Caltech
consist of
a people li
cultural ac
of informat
dividua's a
adequately
however, mo
the specifi
words, they
not the cas
behavioral
into REL as
useful for

HARDWARE EC

It is now p
live-comput
Generally s
for one way
puter with
or employs

ficant:

ortance of in-
ss closely
None of these
e considered
he question-
ate.

ing syntactic
mportant. It
in the data
(This fea-
eaching tool
y laymen in

rocessor is
individuals
velop their
r files.
a difficulty
gence analysts
del I and II

ify temporal
the system.
specially
plications;
ing activity
to the time
jected.)

Currently the California Institute of Technology is proposing to employ the REL system as the basis of a planning laboratory (in its newly built Jurgenson Laboratory for the recently formed Environmental Quality Laboratory corporation. Caltech scientists will co-operate with EQL as they do with the Jet Propulsion Laboratory.

The most extensive application of REL so far as been to a data base gathered over fourteen years (1956-1970) by the Caltech anthropologist Dr. Thayer Scudder. The data consist of over 100,000 items concerning the Gwembe Tonga a people living in Zambia, who have made very dramatic cultural advance during the last decade. The vast amount of information collected through time on over 1,000 individuals affiliated with six communities can be studied adequately only through computer analysis. (To date, however, most software systems have not been designed wit the specific needs of anthropologists in mind; in other words, they really have not been user oriented. This is not the case with REL which was designed specifically for behavioral and social scientists.) Capabilities designed into REL as a result of Scudder's analyses are especially useful for planning applications.

HARDWARE EQUIPMENT CONSIDERATION

It is now possible to use mini-computers for time-shared live-computer interaction with a relational data base. Generally speaking, computing operations have to be paid for one way or another, whether one shares a large computer with other users, buys time from outside sources, or employs a dedicated configuration of mini-computers;

and costs for all three alternatives are roughly comparable. Because SIMU-SCHOOL would benefit greatly from using its own, wholly dedicated computers, the use of a mini-computer configuration is tentatively proposed for SIMU-SCHOOL. It offers the following advantages:

- A relational data system tends to be limited in many ways if it has to take up residence in an existing large system previously designed for other uses. A relational data system is a fairly basic kind of operating system. It controls time-sharing, accepts other computing languages like BASIC or COBOL within its program system, enters data in files, manipulates files, prepares reports, interprets input language, outputs in nearly natural language, etc. Existing systems provide services and impose requirements that conflict with the services and requirements of the relational data system. On the other hand, a configuration of mini-computers and disc drives, while costing no more and probably less, would provide SIMU-SCHOOL with a wholly dedicated facility, completely at its service. Delays, time conflicts, invasions of the program system, loss of data, etc. would be bypassed.

- The SIMU-SCHOOL system would be able to grow in modular fashion. Each field application would be fully compatible with the home-office installation. During initial field operations

it will prob
field confi
dial-up tele
able the sim
to monitor f
two-thirds o
ventions as
after the ma
Houston. Th
Model II it
telephone da
field confi
office insta
and its data
updated simp
disc packs p

- This strategy
of documenta
tion technol
operations,
units at the

- Should any or
prove intere
be possible
I and II) o
III) as a se
stalled in
for indepen
only softwa
existing pr
chaser's sp
ble for the

are roughly com-
enefit greatly
computers, the
is tentatively
the following

be limited
up residence
viously de-
ional data
f operating
ng, accepts
BASIC or
, enters
s, prepares
age, outputs
. Existing
pose re-
he services
nal data sys-
figuration of
while cost-
would pro-
dedicated
vice. Delays,
e program
d be by-

ble to grow
application
the home-office
field operations

it will probably be most useful to tie the field configuration to the home office by dial-up telephone data-link. This will enable the simulation team at the home office to monitor field exercises during the first two-thirds of a year and interpose live interventions as needed during field operations, after the manner of moon-shot monitoring at Houston. Then, if during the field use of Model II it should prove desirable to cut the telephone data-link to the home office, the field configuration would simply copy the home-office installation without further programming, and its data files and operating system could be updated simply by courier -- by bringing it to disc packs prepared and loaded at the home office.

- This strategy will bypass the need for a great deal of documentation on computer programs and simulation technology during the first two years of operations, and yet provide for autonomous field units at the end of the period.

- Should any or all the three models of SIMU-SCHOOL prove interesting to other agencies, it will be possible to package a simulation unit (Models I and II) or a professional planning unit (Model III) as a self-contained system completely installed in its own hardware and offer such units for independent use. To prepare such a unit, the only software requirement would be to duplicate existing programs. For application to the purchaser's specific needs and data, it will be possible for the purchaser to adapt the package by using

the natural language capabilities of the relational data system. In other words, only the services of a systems or applications engineer will be required to produce a self-contained, mini-computer planning unit. Special-purpose computer programming will not be needed.

136